Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS

Founded 1896

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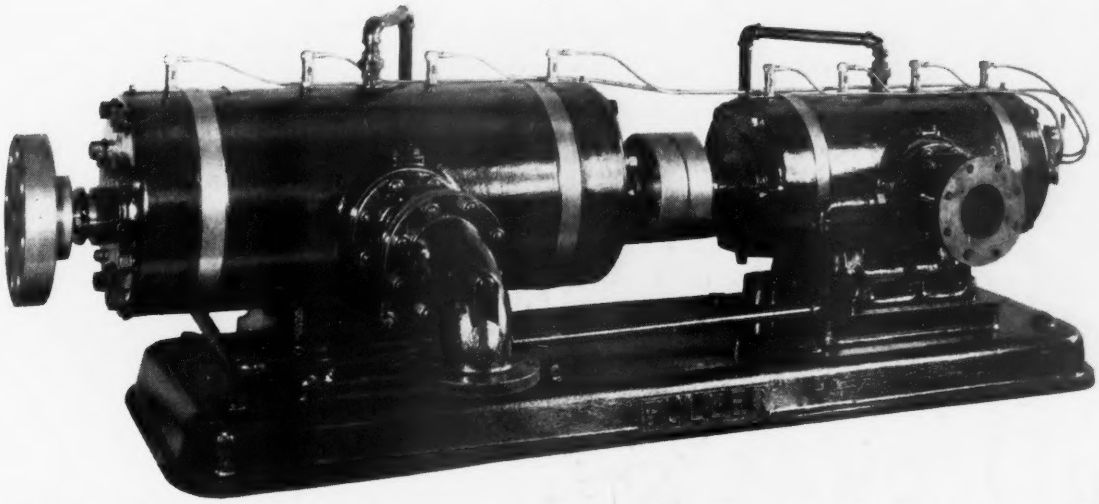

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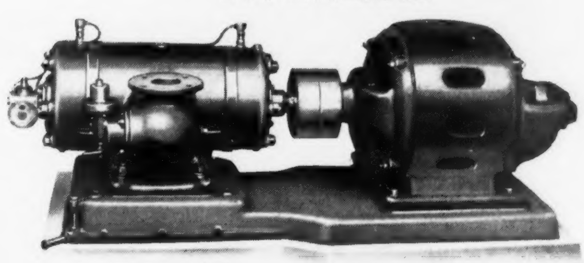

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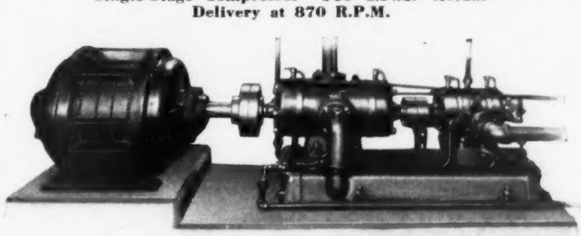

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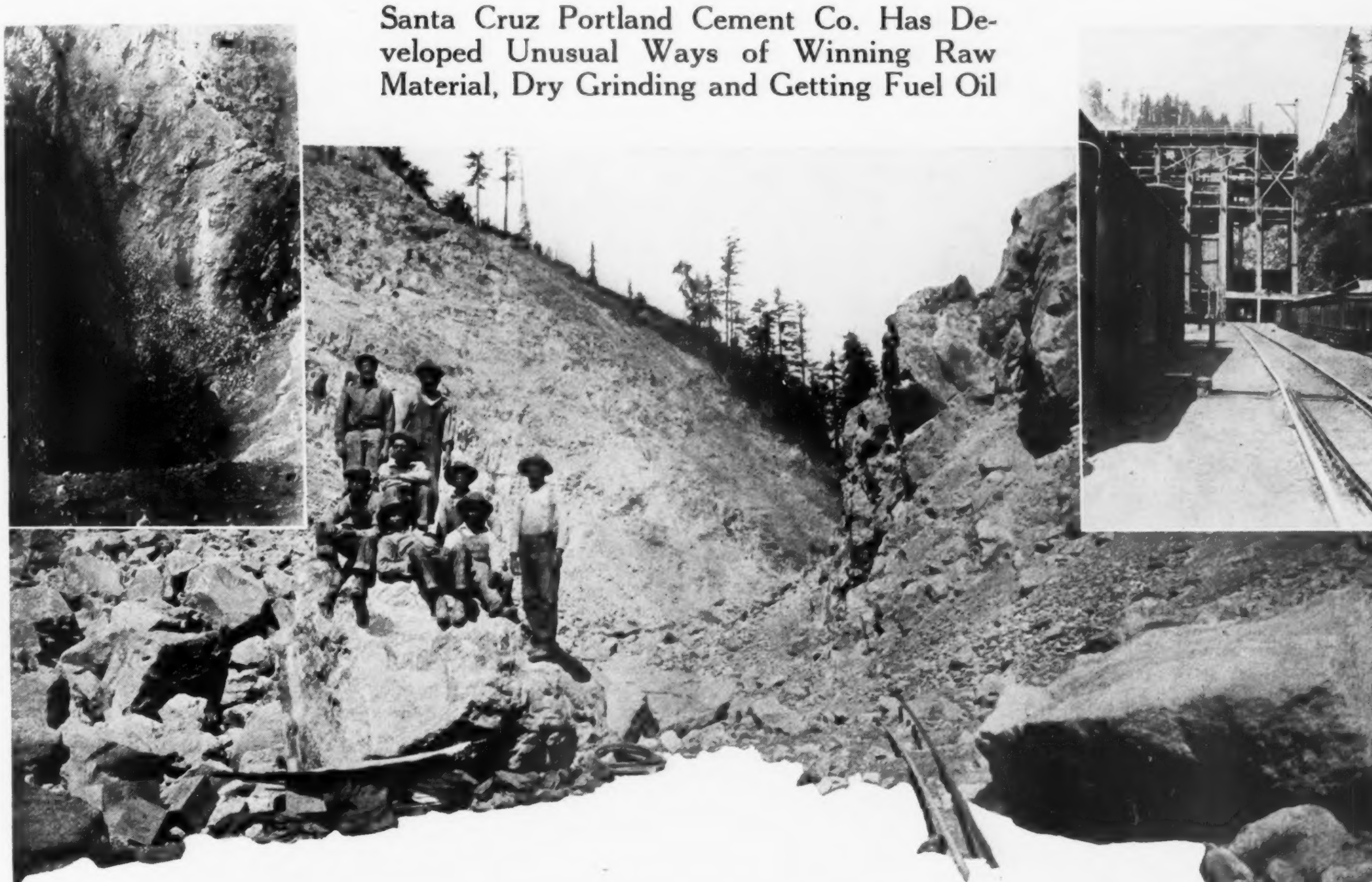
California's Largest Cement Mill Kept Uptodate

Santa Cruz Portland Cement Co. Has Developed Unusual Ways of Winning Raw Material, Dry Grinding and Getting Fuel Oil



View of the limestone deposit in the Santa Cruz quarry and some of the quarry crew. Insert, upper left, top of one of the glory holes. Upper right, the adit to the haulage tunnels

THE PLANT of the Santa Cruz Portland Cement Co. is located at Davenport, on a branch line of the Southern Pacific railroad, 12 miles northeast of Santa Cruz, Calif. The plant is only a short distance from the Pacific ocean, on the side of a gently sloping hill that terminates in a steep bluff at the water's edge. There is no harbor or landing in the immediate vicinity, just the wide expanse of the Pacific ocean. No water shipments can be made from the plant, but oil for fuel is taken from boats lying on the open sea. After preheating on the boats the oil is pumped to steel storage tanks located ashore about three miles north of the plant.

The pipe line serving this series of storage tanks is laid on the bottom of the ocean for about one-half mile, where a depth of 50 ft. is about the average. On the outer end of this pipe line is a 150-ft. length of flexible hose. The pipe line from the sea end starts off at 13-in. diameter and reduces to 10 in. The entire pipe line when not in use is below water and open at the outer end. Its location is marked by a series of buoys. The oil cargo boat picks up the outer end of the flexible hose and discharges the oil to the storage tanks. Facilities are provided at that point for dewatering the oil from the sea water in the pipe line at the outset of pumping operations and for flushing out the heavy oil with lighter oil at the completion of pumping; this is necessary, as the cold sea water soon congeals the heavier fuel oil remaining in the pipe line so that it would be impossible to resume pumping. While all of this equipment is owned and operated by the General Petroleum Corp., it was installed primarily to serve the Santa Cruz plant, and it is interesting to note that this is one of the few places in the world where oil is delivered from the open sea to shore storage. This is only one of the many unique features in connection with the Santa Cruz Portland Cement Co.'s operation, a company that has ever been open to new ideas.

The limestone deposit is located about three miles away from the plant, in the hills

Perhaps the most radical change from ordinary practice started about five years ago when the company changed from open quarry methods to mining limestone by the glory-hole method. More recently another radical change was inaugurated by adopting Hardinge conical mills for both raw and finish grinding.

Change from Quarrying to Mining

The limestone deposit is located about three miles west of the plant, in the hills. A 36-in. gage railroad, 3 miles long, having a maximum grade of about 2% in favor of the loaded trains, connects the mine with the crushing plant. Haulage is done by two 18-ton Baldwin-Westinghouse electric locomotives, and steel cars holding 15 tons each, 20 cars being hauled per trip. The company has 65 of these cars. The electric locomotives and cars were at one time used in Alaska at the Alaska Gasteneau mines.

The cars are all equipped with rectangular steel bodies with a lip or apron at one end that overlaps the top of the next car so when the car is loaded from the chutes in the haulage tunnels no rock is spilled on the track. Six to eight of these empty cars are spotted in front of the raise to be drawn, and unless the chute hangs up, loading is practically continuous until the last car has been loaded. Loading a string of cars in this way during normal operation is a matter of a few minutes at most. To permit continuous loading one of three Baldwin storage-battery locomotives slowly pushes the cars by the draw chute. Spillage to the tracks is prevented by the previously mentioned aprons on the ends of each car. The storage-battery locomotives used are two 6-ton and a one 5-ton. The Exide batteries in one of these locomotives were in service over 73 months. Power requirements for all quarry purposes, including switching in the train yard, are 0.8 kw.-hr. per ton of limestone.

From 32 to 34 men are employed at the mine; 34 men are normally required, 15 above for drilling, barring down, etc., with the remaining men used for loading in the mine, for transportation, track repairs and maintenance of the company's boarding house. This crew can do all the work necessary to produce 1500 tons of limestone per day working six days per week and deliver it to the crushing plant at Davenport.

Mining Safer Than Quarrying

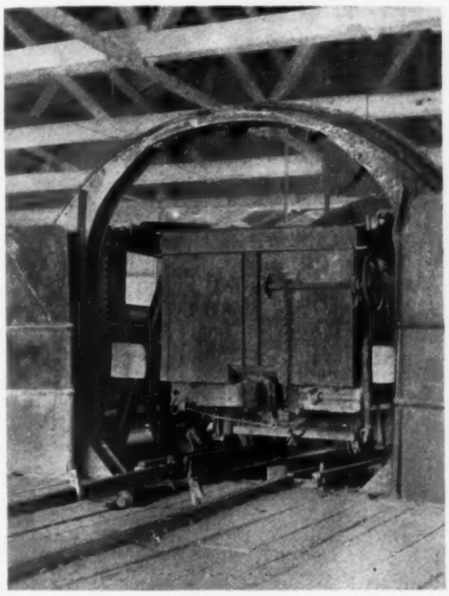
The old quarry was operated from a single bench, and, owing to the steepness and ruggedness of the site, the face reached a height of 350 ft., with considerable trouble from slides loosened by the long winter rains, so the company, acting under the direction of Robert A. Kinzie, consulting engineer with a wide experience in the metal-mining field, had the deposit diamond drilled to get an approximate idea as to its shape and size.

It was found that the limestone deposit is trough-shaped and coincides with a steep ravine that cuts the deposit for its entire length of three-quarters of a mile. The deposit is massive and quite compact, light gray to white in color, and originally covered with clay and sand overburden, most of which was removed several years ago from the immediate vicinity of the ground now being worked. Owing to the topographical

A bird's-eye view of the quarry camp showing its ideal location

conditions, it was not advisable to operate the quarry from a series of benches, as this would have entailed complicated switchbacks, etc.; so a 9-ft. by 12-ft. tunnel was driven under the long axis of the deposit, starting at approximately the same elevation as that of the old crushing plant's foundation. This tunnel has a grade of 0.5% and a short distance from the adit the tunnel branches to form two 9-ft. by 12-ft. tunnels that soon assume parallel positions with respect to each other and to the long axis of the ravine above. These two tunnels run the length of the deposit and are spaced on 60-ft. centers. They are referred to as the main haulage tunnels.

At definite intervals between these two main haulage tunnels and at 30 ft. higher elevation are seven "bulldozing chambers,"

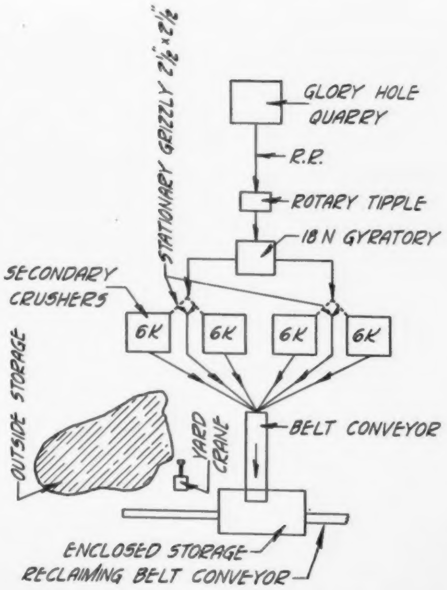


The rotary car tipple acts as unloader as well as crusher feeder

each 80 ft. long and 50 ft. wide and approximately 15 ft. high, flat-topped but hopper-bottom. These were blasted out of the solid limestone. The last chamber has slightly different dimensions, which will be referred to in due course. From the bulldozing chambers three 50-deg. incline drifts (chute raises) were driven from each of the haulage tunnels below; the chute raises are on 30-ft. centers and equally spaced, with three on a side in each haulage tunnel. From the center of the roof of the bulldozing chamber a vertical raise was driven 10 ft. by 11 ft. in cross section, until the raise broke through to the surface from 200 to 270 ft. above.

In driving one of these raises, four men, two per shift, completed a 200-ft. raise in 35 days. They first drove a pilot raise 5 ft. by 5 ft., which was slabbed to full dimensions, working from the bulldozing chambers upward, drawing off enough rock from time to time so as to leave sufficient headroom for the miners to work. The manway raises were driven simultaneously.

Originally there were six bulldozing cham-



Raw material flow sheet of Santa Cruz operation

bers spaced on 120-ft. centers, but recently a seventh raise was put to the surface that was 240 ft. from its center to the next chamber. This last chamber was slightly smaller than the others, being 40 ft. by 80 ft. in area, and instead of six chute raises only two were placed, as the extra chute raises were found by experience to be unnecessary.

Access to the bulldozing chambers is by means of separate manway raises from the haulage tunnels. These connect to the chambers by a series of short and smaller drifts so that miners can go from one chamber to the next without having to go back down into the haulage tunnels. In addition to the main vertical or rock transfer raise, a 5-ft. by 7-ft. manway raise is driven up to or near the surface, and at 40-ft. intervals in this raise 5-ft. by 6-ft. drifts have been run,

Compressor and office buildings at the mine. In the upper background can be seen the excavations made by the glory hole

connecting this manway raise with the transfer raise. One manway raise is so located as to serve two transfer raises with the manway drifts leading off at approximately right angles to the two transfer raises.

These 40-ft. spaced drifts are used in case the rock in the transfer raise becomes hung up; in that event the miners remove any accumulated rock from the throat of the drift until the transfer raise is reached. The practice is then to insert sticks of dynamite fastened to long lath under the overhanging rock in the raise and explode these electrically. This is repeated as often as necessary until the obstruction is removed.

Once the raise has broken through to the surface, mining can be commenced. This consists simply in caving the throat of the

The primary crusher discharging to four secondary crushers

raise, starting at the surface until the throat becomes funnel-shaped. This funnel acts to catch the limestone as it is broken down from above. Mining can be continued until the slopes of this cone become too flat for the rock to slide into the funnel. The amount of rock secured from each raise will depend on its vertical length and the angle of repose of the material. It is estimated that the most recent raise, No. 7, which has a total length of 270 ft. and a net vertical length of 225 ft., will produce 3,000,000 tons of limestone. So far 2,300,000 tons have been taken from the other six raises; which does not by any means exhaust their reserves of limestone above.

Breaking Stone for Chuting

One of the greatest problems that confronts the operator here is to break the limestone into sizes that will not choke the raises and chutes. This limestone tends to break "blocky," so L. R. Davis, mine superintendent, prefers to use small diameter holes, close spacing and a fast nitroglycerin dynamite to get the desired shattering. From four to five

tons of stone are secured per pound of explosive.

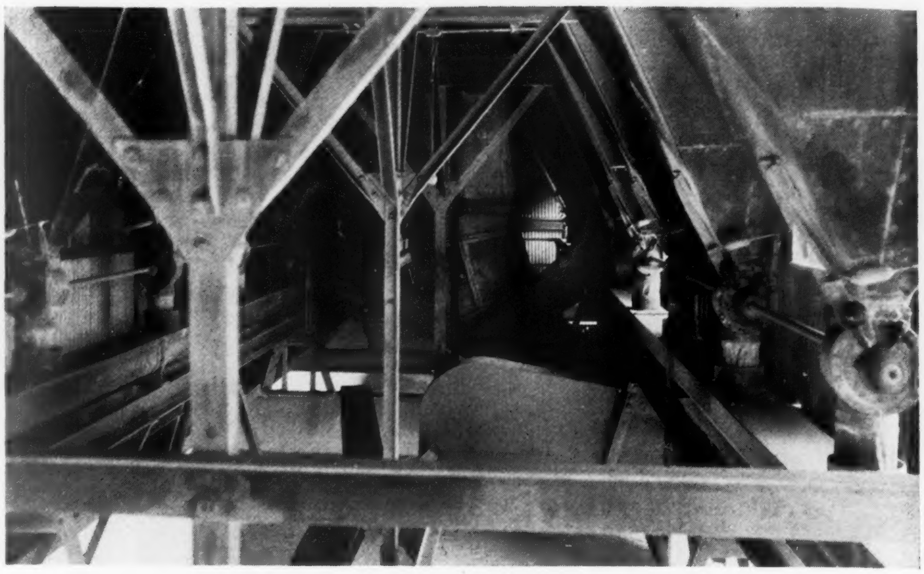
In the event that large chunks of limestone do get into the throat of the raise, when possible they are drilled and broken up there, but this is not always convenient or possible. The pieces are then allowed to flow on down to the bulldozing chambers, where they are drilled and broken up so as to pass the loading chutes. The bulldozing chambers were built primarily for this purpose. Large stones in this chamber are drilled with jackhammer drills, using a long drill steel so that the miner need not endanger himself unnecessarily. Safety belts are also available in case there is any chance of the miners falling into the chute raises.

During wet weather, owing to the clay in the matrix, there is some danger of the stone mushrooming into the bulldozing chambers, so during these infrequent occasions extreme care is exercised by the men working in the vicinity. Sometimes stone has to be blasted at the mouth of the loading chutes, which is done by drilling with jackhammer drills.

The gates that control the flow of stone to the cars from the chute raises are 5 ft. wide, bottom cut-off, quadrant type, operated by duplicate air cylinders, and are so arranged that the loader stands at the side of the chute and not in front, as was previous practice. As now arranged, there is very small chance of the operator being injured from rock spills.

From a cement production standpoint the mining operations have been very successful and with low costs; technique has been developed to a high degree so that the stone as drawn will require very little clay addition. Sufficient overburden is allowed to fall into each raise to meet the requirements. This not only saves stripping costs but cuts the cost of clay production, which is a rather expensive commodity at the Davenport plant. The amount of clay to be hauled 18 miles from the clay pits at Glenwood has been reduced to a few tons per day, and this has practically eliminated the cost of maintaining that operation and the incidental drying operation.

No timbering is needed in the raises, bulldozing chambers, or the draw raises except a small amount for chute construction, maintaining ladderways in the manway raises, and a few sets in loose ground in the main haulage tunnels. Water is removed by a drainage ditch at the side of the haulage tunnels, which discharges by gravity at its low end and connects with a concrete vertical shaft at the upper end of the haulage tunnel. This shaft receives any flood waters that come down the ravine and prevents this water from flowing into the glory holes. The shaft also contains the water-supply pipes bringing water for domestic purposes to the quarry camp site and for the main drill lines.



Dust collectors discharge to screw conveyors returning rock and clay dust back into the system

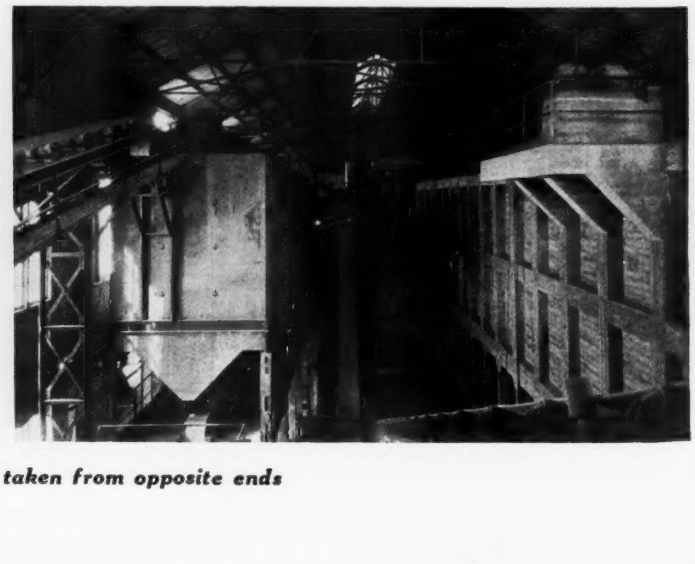
The latest raise, No. 7, cost, inclusive of the bulldozing chamber, manways, raise chutes and 300-ft. extension of the main 9-ft. by 12-ft. haulage tunnels, a total of $26,000, which on the basis of 3,000,000 tons of stone opened up by this raise amounts to 86 cents per ton for development work.

During the winter months the region has a high rainfall, so the transfer raises are kept drawn down quite low to facilitate easy drainage and to permit easier drawing in the chutes below. During the summer months there is practically no rainfall, so at that time large reserves of limestone can be kept on hand. The transfer raises, bulldozing chambers and draw raises hold approximately 5000 tons of limestone each, or a total of 35,000 tons of broken limestone is always available in case of bad weather.

Accidents have been rare both in the mine and on the surface. This is in a measure due to the high type of workmen available. Climatic conditions are ideal, there is plenty of large and small game in the immediate vicinity, there is trout and deep-sea fishing in abundance, as well as easy accessibility to San Francisco for week-end vacations—all of which tend to draw and hold desirable workmen.

So far the limestone has been taken practically all from the west side of the ravine, and a large tonnage is still available there. The east side has hardly been touched as yet. Some stripping is contemplated on the upper areas where is located the blacksmith shop. The drill steel is lowered to the open glory holes by a homemade gravity aerial tramway.

Air is supplied by two Ingersoll-Rand (500-cu. ft. per min. each) and one 1205-



Two views of the raw mill taken from opposite ends

cu. ft. per min. class JC Duplex Ingersoll-Rand compressor, housed in a corrugated-iron building near the quarry office.

Revolutionary Changes in Plant

A radical departure from ordinary cement-mill practice was made by the company two years ago, when it installed a 10-ft. by 66-in. Hardinge mill, replacing two-stage grinding. This was one of the first Hardinge mills installed in any dry process cement plant in the United States, and, as was to be expected, considerable alteration and change in practice had to be carried out both in preparation of feed material for the Hardinge mills and in handling their discharge products.

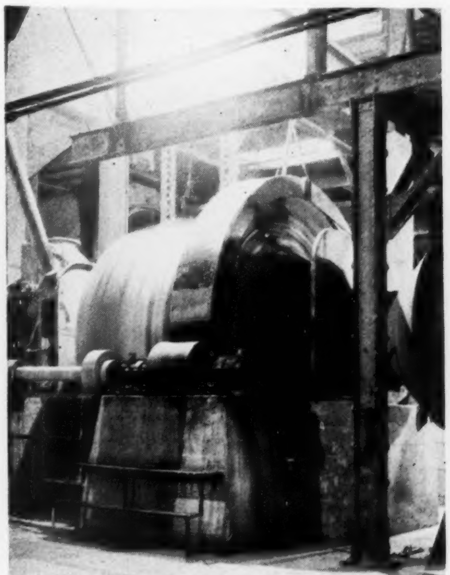
After considerable experimenting and trial tests with the first mill installed it was decided to adopt mills of this type entirely for both raw and finish grinding. The problems connected with their use were first worked out on the raw side after installing a second Hardinge mill. Three mills are now installed on the raw end.

The entire raw grinding end has been gradually altered, new steel bins have been added as well as some of reinforced concrete, that are exceptionally noteworthy for their pleasing appearance. Steel floor and stair treads, using Irving Iron Works subway grating, are used throughout the new structures, which are of steel construction.

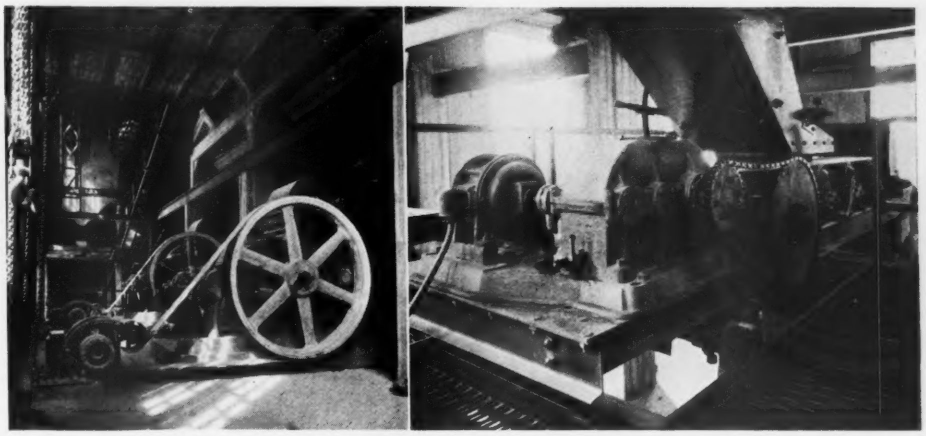
New electric motors, both General Electric and Westinghouse, have been placed in the plant, and all drives where gear reductions are necessary are through Pacific Gear and Tool Works reduction units. Stephens-Adamson belt conveyors, idlers, bucket elevators and pan feeders are used throughout.

Crushing Plant

The cars of limestone on arriving at the plant are spotted on an electrically-operated, rotary tipple, driven by a 25-hp. Westinghouse motor through a Pacific Gear reduction unit. Formerly an air-operated tipple



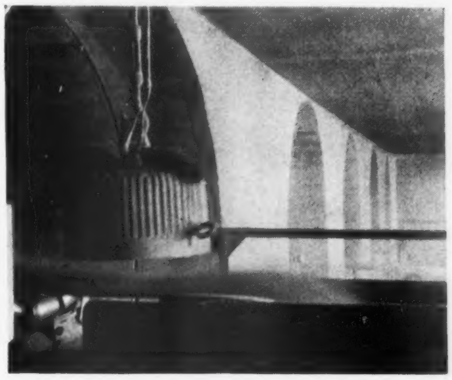
One of the pulverizing mills



Two of the three secondary rolls in the raw mill. At right, the motor and gear reduction driving feeders to the secondary rolls

was used. The cars are spotted on the tipple by an endless rope drag, to which are fastened lugs that engage with the bottom of the car. Two "Little Tugger" air hoists operate the on and off bearing cables. The tipple functions not only as an unloader but as a crusher feeder as well by simply controlling the rate of turning of the tipple.

The rock falls to an 18N Allis-Chalmers



Magnetic pulley over the belt before drying removes a surprising amount of tramp iron

two-way discharge, gyratory crusher, the two streams splitting and passing over four stationary grizzlies ($2\frac{1}{2}$-in. by $2\frac{1}{2}$-in. square openings) to four No. 6 Gates gyratory crushers. The primary crusher, secondary crushers and all the raw rock handling equipment, storage bins, etc., have sufficient capacity so that it is only necessary to operate that portion of the plant 8 hours per day. The primary crusher has a capacity of 300 tons per hour and is driven by a 200-hp. Westinghouse motor. The four Gates crushers are driven by two 150-hp., 2200-volt induction motors. The secondary crushers discharge to a 36-in. inclined belt conveyor from which the $2\frac{1}{2}$-in. material eventually reaches both inside and outside storage facilities.

Provisions are made for screening and keeping separate two grades of crushed raw material, a fairly coarse or high lime content material and the fines, which are comparatively low in lime but high in clay content. The fines or coarse can be returned to the system by a series of belt conveyors operated in tunnels from below and at approximations that will keep the lime content within fairly reasonable limits (first blend). This part of the operation is not necessarily new, although slight changes in operating methods here were adopted to conform to needs farther along in the mill flow sheet.

The fine and coarse limestone in the outside storage can be cast back for storage or returned to locations that will allow the material to fall to the reciprocating feeders in the tunnel below. A Bucyrus, Diesel-powered, convertible shovel, using a $\frac{3}{4}$-yd. orange-peel bucket, is used for this work. The shovel is mounted on crawler treads and is full revolving.

From the rock bins the stone converges to a 24-in. belt running in a concrete tunnel to a cross conveyor that discharges to two

End view of pulverizer showing bleeder pipe with gate regulator

7½-ft. by 72-ft. rotary driers; the driers in turn discharge to two bucket elevators serving a long pan conveyor running horizontally over the tops of the rock storage bins. There are five of these bins holding 375 tons each, and a sixth for clay holding 335 tons. These bins are of reinforced concrete. Three of the rock bins are used for storage of stone that has a reasonably high lime content and the remaining two for limestone of lower lime content. The bins are referred to as the "hi-low" bins.

Throughout the new raw grinding plant a series of suction pipes are placed at all locations where there would be dust. The dust collected at these points is delivered to Sly dust collectors located near the "hi-low" bins, which discharge their contents into these bins by a series of small screw conveyors.

By determining the lime content of the material in the "hi-low" bins a second raw blend is obtained by regulation of the amount of stone taken from any or all of these bins with or without the addition of clay to the belt as it passes under the bins. The clay is fed through a reciprocating quadrant cut-off gate made by the Stockton Iron Works.

The five "hi-low" bins all discharge to five Stephens-Adamson, self-contained, pan feeders set to discharge to a 24-in. belt conveyor. This belt conveyor serves a No. 7 Symons cone crusher set to deliver a ⅜-in. product. It is direct connected to a 250-hp. Westinghouse synchronous motor. The conveyor also has a Dings "High Duty" magnetic head pulley to protect the rolls from any tramp iron.

The No. 7 Symons cone crusher has a capacity of 170 tons of ⅜-in. product per hour and discharges to a second 30-in. belt, which elevates the limestone to a concrete bin constructed over a battery of ten, 4-ft. by 6-ft. Hum-mer screens, placed in two parallel rows of five screens each. The screens are equipped with ¾-in. by 3/32-in. wire cloth, and are fed by roll feeders with quadrant top cut-off gates. Five of the feeders on a side are driven by a single 5-hp. General Electric motor through Pacific Gear reduction units.

A picture of the kiln room and oil heater

The 5-mesh oversize from the Hum-mer screens falls to a third 30-in. belt conveyor and is returned to a concrete bin, or surge bin, ahead of three pairs of 40-in. by 36-in. Allis-Chalmers secondary reduction rolls. The bin feeds three short belt conveyors which in turn feed the rolls. The head pulleys of these conveyors are also equipped with Dings magnetic pulleys.

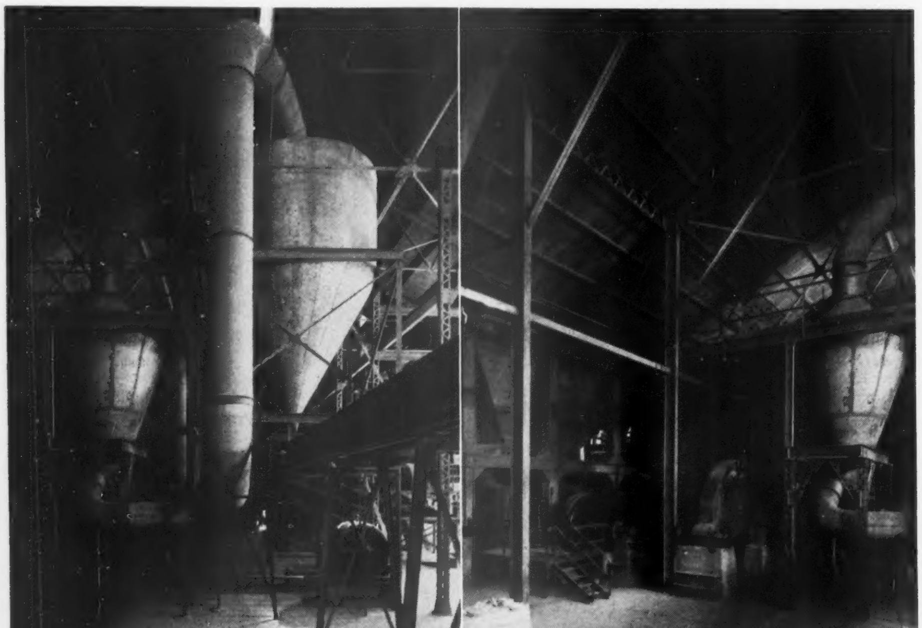
The three secondary rolls are set to $\frac{3}{16}$ in. and the product discharges to the same off-bearing belt serving the primary rolls, and hence is rescreened through the Hum-mers. The rolls are each belt connected to two 50-hp. Westinghouse induction motors on short center drives using Link-Belt tighteners.

The minus 5-mesh limestone from the Hum-mer screens falls to a fourth inclined belt conveyor that runs parallel to and at the same inclination as the plus 5-mesh material's conveyor. The material on the former belt is automatically sampled as it discharges to a short cross screw conveyor, that in turn discharges to a fifth inclined belt conveyor. This conveyor extends over the tops of the steel storage bins. This conveyor is 24 in. wide and 480 ft. between centers. The other conveyors range in lengths from 100 ft. to 200 ft.

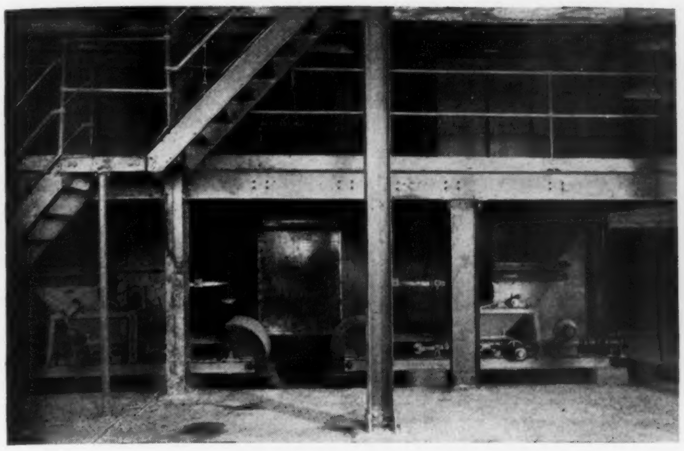
The longer belt passes over 40 steel bins and is unloaded by any of three Stephens-Adamson, hand-set, belt-driven trippers. The bins are arranged in a single straight row of two banks, one bank having 28 bins and the other 12 bins. When these bins are filled the samples taken from the automatic sampler are analyzed by the control chemist, whose laboratory is only a few feet from the place where sample is taken. This results in quicker work and more accurate plant control, for the chemist can easily see at a glance almost, what is going on in the raw-mix department.

All of the belt conveyors are driven at their head pulleys by General Electric motors through Pacific Gear reduction units and require a total of 115 hp. to operate. In the order that they are mentioned in the text, No. 1 has 15 hp.; No. 2, 30 hp.; No. 3, 30 hp.; No. 4, 20 hp., and No. 5, 30 hp. The pan conveyors feeding No. 1 conveyor require 5 hp. each.

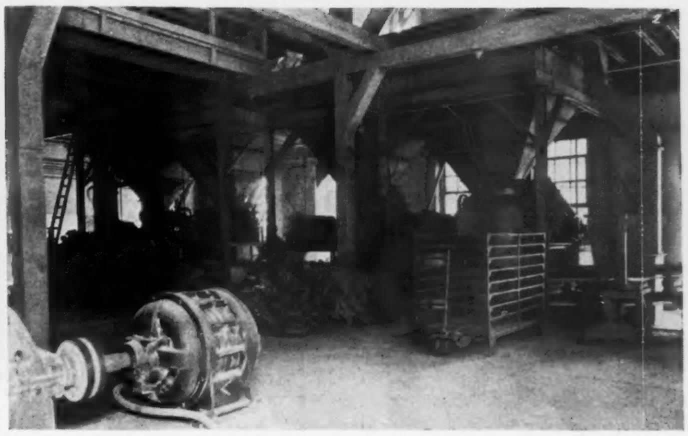
The contents of the 40 steel, hopper-bottomed bins, after analysis, are drawn to 24-in. belt conveyors operating underneath, the two conveyors converging to two steel blending bins at the ends of the two banks of storage bins. By regulation of the size of the discharge orifice from any of these 40 bins and by choosing those bins from which analyses show a proper mix can be secured, a third blend is made before pulverizing. At present two belts operate under these bins, but provision has been made to install



At right is shown synchronous motor driving pulverizing unit. The other view shows some of the dust-collecting equipment



The blending bins discharge to automatic weighing devices



An interior view of the pack house at Davenport

an additional belt should that become necessary. A 15-hp. motor is required to operate these two belts.

The two blending bins each discharge to two 36-in. by 4-ft. 6-in. Schaffer poidometers, that are so regulated as to take a 50-50 feed from each bin. The poidometer belts converge and discharge by chutes to the boot of a bucket elevator, that in turn discharges to a 24-in. belt conveyor. This conveyor discharges to a cross conveyor running over the tops of the Hardinge mill feed bins. This belt is unloaded by two stationary trippers. A total of 30 hp. is required for these three conveyor and elevator units.

Four reinforced-concrete bins, holding 1000 tons each, have been provided for feeding the Hardinge mills. This storage capacity makes it possible to operate that part of the mill on a 24-hour-day basis, while all equipment ahead of this bin has ample capacity so that it need operate only 8 hours per day.

There are three 10-ft. by 66-in. Hardinge conical mills, each equipped with Hardinge air separators and a No. 100 Clarage fan. The fan is driven by a 100-hp., variable-speed motor. The mills carry a ball load of 32 tons each, mostly 1-in., 1½-in., with a few 2-in., and operate at 18 r.p.m. The mills are each driven by 400-hp. General Electric synchronous motors. A total of 50 tons per hour of feed material passes through each mill per hour, about half of which is returned to each mill from either the Hardinge or the Sturtevant air separators which are in closed circuit with the mills.

The Hardinge mills are fed by an 18-in. belt conveyor that receives its feed from a feeder synchronized with the mill motor. Each feed conveyor carries into the system 25 tons per hour of new raw material which, regardless of the deposition and fineness of the output, is the mill capacity. The oversize or circulating tonnage returned by the Hardinge air separators, plus the feed tonnage, is passed finally through two Sturtevant air separators, the oversize from these separators also being returned to the mills.

By carrying such a heavy circulating load in each mill greater capacities are obtained and the wear on the manganese-steel liners is reduced to a minimum. The present liners have been in use for two years and show very little if any sign of wear. Fifteen years was given as the probable minimum life of the liners, judging from appearances.

The two Sturtevant air separators are each belted to a 50-hp. G. E. induction motor. The series of screw conveyors, belt conveyors, bucket elevator, etc., that deliver the material to the Sturtevant separators, including the conveyors returning oversize to the Hardinge mills, require a total of 55 hp., and is divided between four General Electric motors with Pacific Gear drives.

The finished raw material from the air separators is chuted to a screw conveyor for delivery to the final blending bins.

The following screen analyses are from monthly average samples:

FEED TO HARDINGE MILLS

	Plus 4-mesh	1.0%
Minus 4-mesh	Plus 6-mesh	9.5
Minus 6-mesh	Plus 10-mesh	25.8
Minus 10-mesh	Plus 20-mesh	16.0
Minus 20-mesh	Plus 40-mesh	12.9
Minus 40-mesh	Plus 80-mesh	13.9
Minus 80-mesh	Plus 100-mesh	1.5
Minus 100-mesh	Plus 200-mesh	6.8
Minus 200-mesh		12.6
Total		100.0%

FEED TO STURTEVANT SEPARATORS

	Plus 20-mesh	5.6%
Minus 20-mesh	Plus 80-mesh	23.4
Minus 80-mesh	Plus 100-mesh	7.3
Minus 100-mesh	Plus 200-mesh	31.3
Minus 200-mesh		32.4
Total		100.0%

FINISHED RAW MATERIAL FROM STURTEVANT SEPARATORS

90% minus 200-mesh

The finished material through a system of screw conveyors is delivered to eight 320-ton concrete blending tanks. Four tanks are filled at one time and four are emptied at one time, but no material is drawn from those silos being filled. This is the fifth blend that the raw material receives.

The product from the four blending silos passes to eighteen 7½-ft. by 7-ft. by 125-ft. kilns by a screw conveyor that delivers any excess to a surge bin at the end of the conveyor, returning the excess to the feed conveyor by another screw conveyor. As the first conveyor carries considerable of an overload, or rather an excess of material, the amount of returning material is correspondingly large, the net result of which is a sixth and final blend.

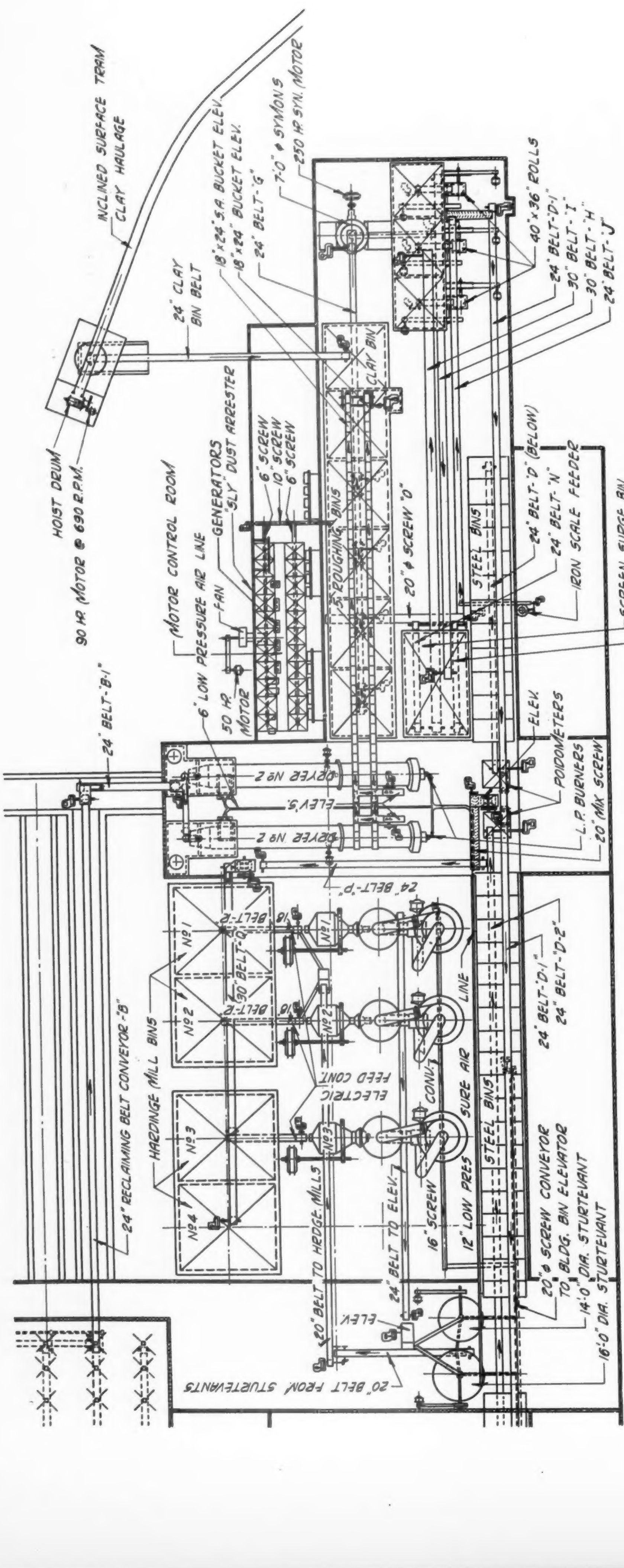
On the finish side two Hardinge mills have been installed of the same size as those in the raw department. The Hardinge mills are fed by clinker that passes through two series of rolls operating in closed circuit with four Hum-mer screens, much after the same manner as in the raw mills, except that no additional air separation equipment is used other than that supplied by the Hardinge company. Poidometers are used for proportioning the clinker and gypsum.

Calcined gypsum is used for retarder, the gypsum being calcined in a Raymond "calcine-while-you-grind" mill. Incidentally, this is said to be the first commercial application of that process. The installation is said to be highly satisfactory from a mechanical standpoint, as well as making a fairly uniform stucco.

There are six ball and six tube mills used exclusively for grinding "oil well" cement. This cement approaches high early strength portland cement in its properties. It is ground finer, is harder burned, and has a higher specific gravity than the standard portland cement. A 4-in. Fuller-Kinyon pump handles the oil well cement from pulverizers to storage, and two 6-in. pumps handle the standard cement. The Santa Cruz Portland Cement Co. also produces a plastic cement, which with its other products are shipped in any of the ordinary containers.

A plan of operation in the Santa Cruz plant is shown on page 48.

The principal offices of the Santa Cruz Portland Cement Co. are in the Crocker Building, San Francisco. George T. Cameron is president; C. E. Green and W. W. Crocker are vice-presidents; W. R. Berry, secretary and treasurer; George R. Gay, general manager; W. G. Higgins, purchasing agent; Fred Davis, general superintendent, and E. W. Rice, chief chemist.



Plan of operation in California's largest cement mill, that of the Santa Cruz Portland Cement Co., located at Davenport, 12 miles northeast of Santa Cruz

Sand and Gravel Taken from Historic Ground*

MIDWAY between the Manor and Terminal sand and gravel plants of the Warner Co. (Philadelphia, Penn.), near Morrisville, is the site of William Penn's homestead. The Delaware river is in front of it and the other sides are bounded by Warner Co. properties.

This locality, Manor and Penn plants in particular, derive their names from Penn's Manor, which originally covered 8431 acres, probably embracing all our up-river sand and gravel plants along with Morrisville and Tullytown.

Penn erected this fine homestead in 1663 with brick he imported from England. It cost him about $30, a large sum of money in those days. What a beautiful place it was, surrounded by gardens and fruit trees planted by the founder of Pennsylvania with his own hands. The Delaware's bank was but 150 yd. from the front of the house.

History does not tell us when the homestead was completed, but it evidently took several years to build, as Penn did not occupy it until his second visit to America in 1699. I paid a visit to the place recently and strolled through the yard to the river bank. It was not difficult to picture brilliant colonial settings with distinguished guests being entertained on the lawn by William Penn. It was here that he met his council and also also made several treaties with the Indians.

It may be interesting to know how Penn came to locate here. During his first visit to America he lived near Front and Market streets in Philadelphia. It seems he was not contented there, so he sailed up the river in his ship *Welcome* in search of a site to build a new summer home. He described "at the big bend in the river" as the most beautiful spot he could find, and landed here. He named the river "Welcome Creek" after his ship, but it was later changed to Delaware river.

The original mansion was destroyed by fire early in the 19th century. On these same foundations the present house was erected. Thomas Collins, night watchman at our Manor plant, now makes it his home.

From time to time the estate was reduced, and when it was finally sold by the Penn heirs it consisted of only about 500 acres. The territory covered by the Manor became a farming district, populated mostly by Quakers, descendants of the early settlers, to whom no doubt Penn sold the land. An ancient Quaker church stands near by.

The site of the old Penn homestead, which includes five acres, was presented to the state of Pennsylvania last year by Charles Warner, president of the company. We understand that this historic place is to be made a public park.

*An article by George Obermier, in the *Warner-American News*.

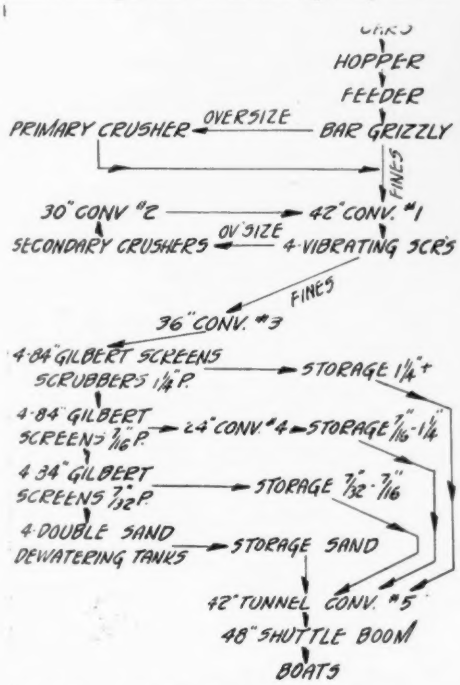
Revamping a New Gravel Plant for Efficiency and Output

Material Service Corporation Speeds Up Production by Many Simple Changes in Plant Completed Just a Year Ago

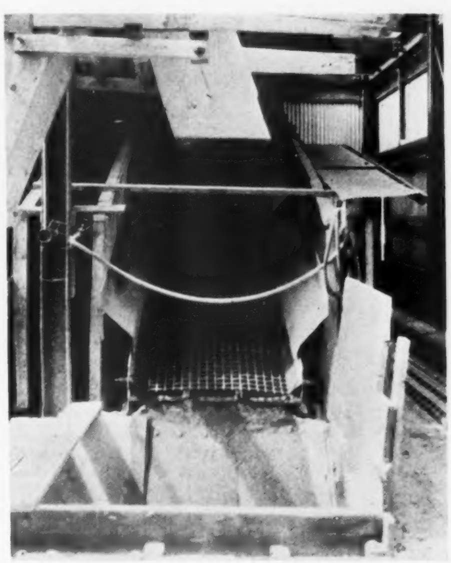
WHEN AN EXPRIENCED PRODUCER designs and builds a new plant there are, as a rule, incorporated in the new operation ideas that are the product of much previous experience and observation; and the owners believe to be correct, or "the last word." But while producers are interested, both from a news angle and operating viewpoint, in the construction details of new plants, in the last analysis they have a thought in the back of their minds about the ultimate results of the new ideas—How did they work out? in other words. With this in mind, a second visit was recently made to the plant of the Material Service Corp., of Chicago, Ill., at Lockport, Ill. The plant when first put in operation, just about a year ago, was described in ROCK PRODUCTS, August 17, 1929.

Concrete and steel bridge connecting plant and pit. The crane, shown on page 52, had to pass under this bridge to get to its location, down stream

It may not be amiss to remind manufacturers of plant equipment that a visit after a year or so of operating by their customers would be a profitable investment. They would see how their equipment with minor changes has contributed greatly to the success of the operation. We do not mean a short sketchy salesman's visit, but a real study of the operation. Very often the operator has taken a more or less crude machine and whipped it into a first class and useful implement. These are the changes that are of vital importance and interest, or should be, to both the user and maker.



Flow sheet of the Material Service Corp., Paul Ales plant, previous to various improving installations outlined in this story and indicated in flow sheet, opposite column

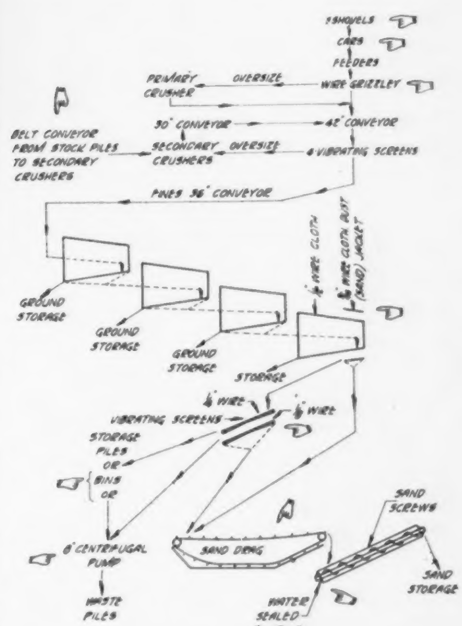


One of the vibrating screens in the preliminary screening and crushing plant

The changes at the Paul Ales plant are interesting and of importance though minor from the viewpoint of cost or size of alterations. For instance, the original flow sheet for production of the sand called for a 7/32-in. wire cloth on the lower Gilbert conical screen, with the throughs passing to double-screw, sand-washing boxes. This produced a minus 7/32-in. sand that was chuted to ground storage with the overflow passing to waste. This operation did not produce the desired material and also threw too much of a load of fine material on the end Gilbert screen, so that it was very difficult to get a clean product farther back along the screen flow line when operating at the estimated capacity. To overcome this problem, the 7/32-in. wire cloth on the lower conical screen was replaced with 7/16-in. wire cloth, and the smaller end of the screen was provided with a jacket of 3/16-in. wire cloth. This jacket is 30 in. long and slopes to conform to the main conical screen. Immediataly below each of the double-jacketed conical screens was installed a duplicate set of Universal vibrating screens, these screens being placed in such a fashion that they, for all intents and purposes, act as double-decked screens.

The amount of head room available was extremely small, but these screens are admirably suited to the job and are compact, yet accessible.

In addition to the four "double-decked" Universal screens, two 48-in. sand drags were installed below the vibrating screens



The hands point to some of the changes made at the Material Service Corp. plant at Lockport, Ill.

The old grizzly bars have been replaced with manganese steel screen that gives more satisfactory service

in such a manner that they discharge their sand to the previously mentioned screw, sand classifiers. The flow of material then becomes as follows:

The end Gilbert screen (Stephens-Adamson) receives a feed material of 11/16-in. and fines, and as the screen has 7/16-in. square openings, it produces what is referred to as No. 6 gravel, which is chuted to ground storage. The bulk of the minus 7/16-in. material and water passes to the short jacket of this screen, the jacket having 3/16-in. wire cloth. This screen immediately removes the greater bulk of sand (minus 3/16-in.) also water which is passed on to one of the two new 48-in. sand drags. All the oversize from the short jacket, and the throughs from the remaining length of the Gilbert screen, falls to the top deck of the 3-ft. by 6-ft. Universal screen, which is provided with ¼-in. wire cloth. The oversize roofing gravel (¼ in. to 7/16 in.), is chuted to ground storage. The minus ¼ in. falls to the lower deck of the vibrating screen, which has ⅛-in. wire cloth. The fines from this deck fall to the same 48-in. sand drag mentioned above. The oversize from the lower deck of the Universal screens is at present a waste product. This material passes through a 6-in. pipe line to an 8-in. Morris sand pump, and is pumped to a waste pile from which the product can be easily reclaimed again if need be.

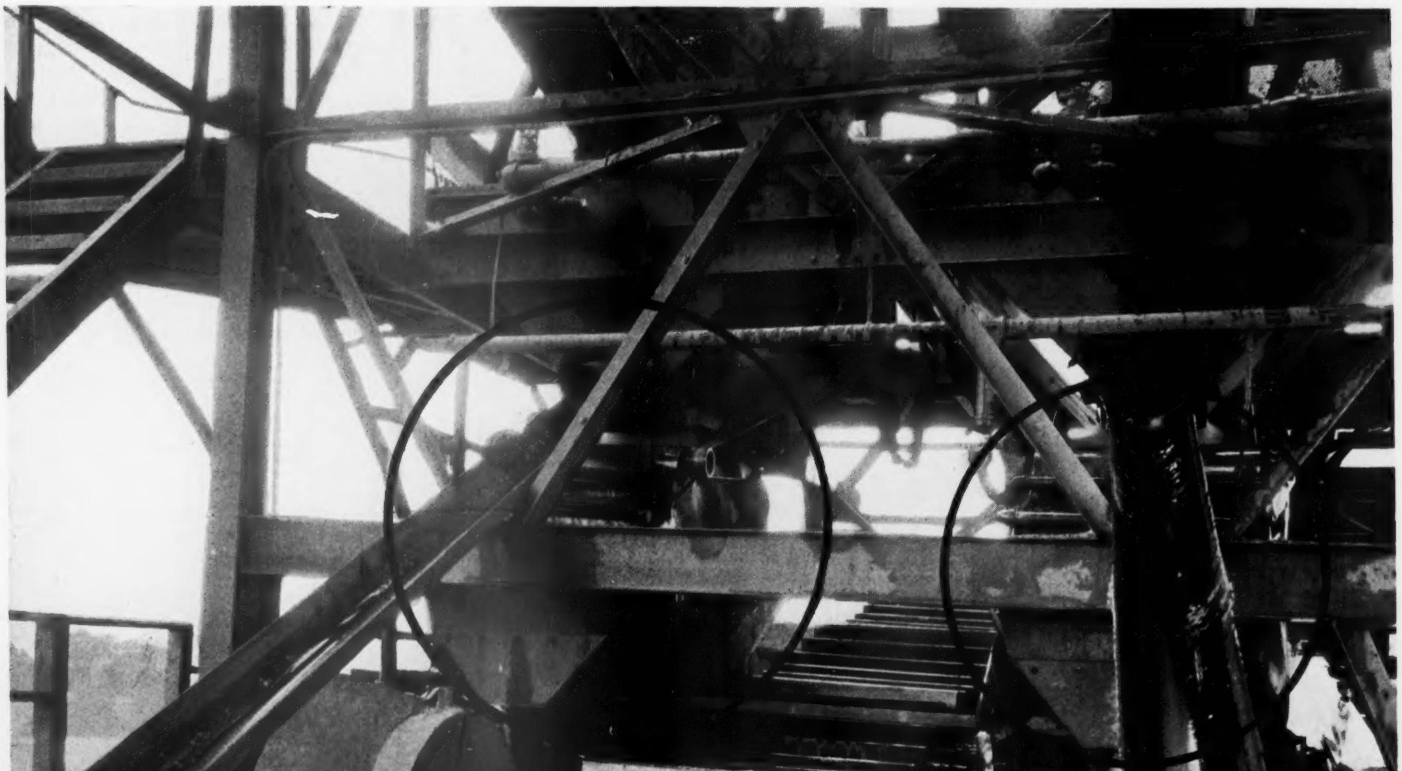
Incidentally an endless rubber belt is now used in driving this pump, eliminating delays due to belt lacing. This belt was made for the job by the Hewitt-Gutta Percha Rubber Corp.

The eight Universal screens are all driven by a 7½-hp. induction motor, which by means of a Texrope drive, serves a line shaft. From the line shaft each vibrator is driven by a short 2-in. belt. This method of drive is novel and economical.

Two parallel 1½-in. perforated pipes spray clean water on the upper decks of the vibrating screens.

The spring knuckles under Universal screens are protected from grit and sands by simply slipping a piece of an old inner tube over this bearing. While this is a simple method of preventing excess wear on these bearings, it is a kink that is worth while.

Since the above mentioned changes were made at the screening and washing plant, no trouble has been experienced in meeting any and all specifications in the state of



A compact installation, two of the vibrating screens, one on each side of the sand drag

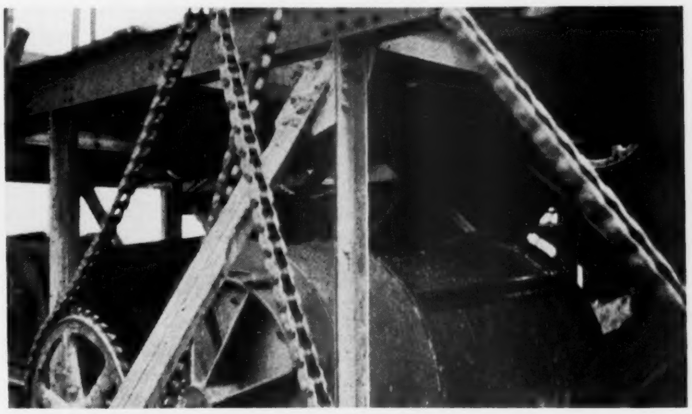
Illinois for either sand or gravel and at the same time they have made possible large increases in capacity.

Another change of mechanical nature, a change that did not affect the quality of the material but did eliminate delays and and repair bills, was in connection with the lower bearing and stuffing boxes of the screw classifiers. Originally the stuffing boxes were of iron, which soon rusted, making it practically impossible to tighten the gland. These iron stuffing boxes were replaced by brass and that trouble was eliminated. Further, owing to the abrasive action of the sand, the bearings would be cut out in 24 to 48 hours, so F. W. Herkel, superintendent, installed a ¾-in. water line to each gland, as shown by the illustration. The flow of clean water passing around the bearing and into the sand boxes kept the bearings free from sand. From present indications these bearings will now last indefinitely. There were no objections to using a full flow of water to these bearings, as additional clean water was added at the screws anyhow, but in the event that excess water was objectionable the sand could have been kept from working into the bearing by maintaining a slight flow of clean water at sufficient pressure to offset the hydrostatic head in the toe of the sand boxes.

By far the greater part of the material produced at this plant is shipped to distribution yards in the city of Chicago in self-unloading boats via the Chicago Drainage Canal.

The boats are loaded by a 42-in. belt conveyor that passes through a tunnel under the central portion of the stockpiles. The belt is immediately below the screens and when this centrally located pile or piles becomes complete, the excess is carried to one side by a 4-yd. Beaumont drag scraper. The same drag scraper also returns the stored material to the gates over the loading belt when needed. The drag scraper is of unusual size, a size necessary to load boats at the rate of 1000 tons per hour, and at the outboard end has two stationary 40-ft. steel

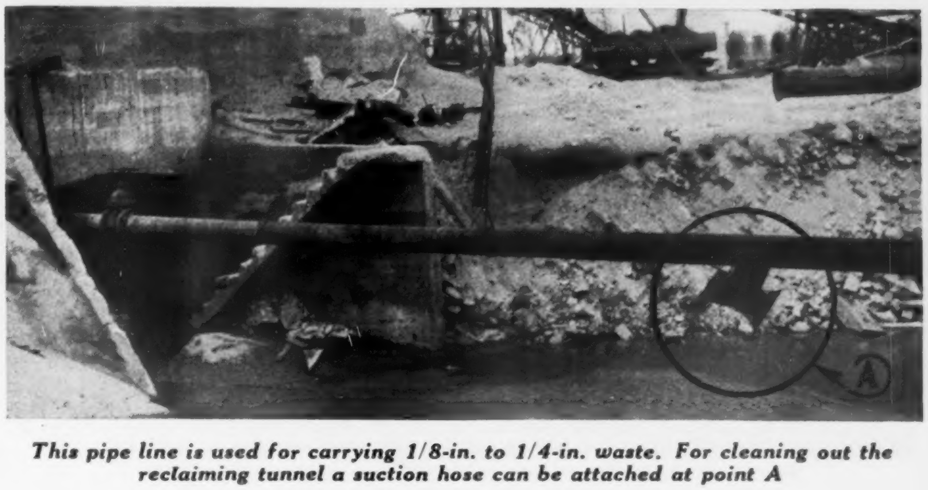
The 1/8-in. to 1/4-in. product is pumped to waste through this 8-in. pump. Note use of endless belt which has practically eliminated belt troubles



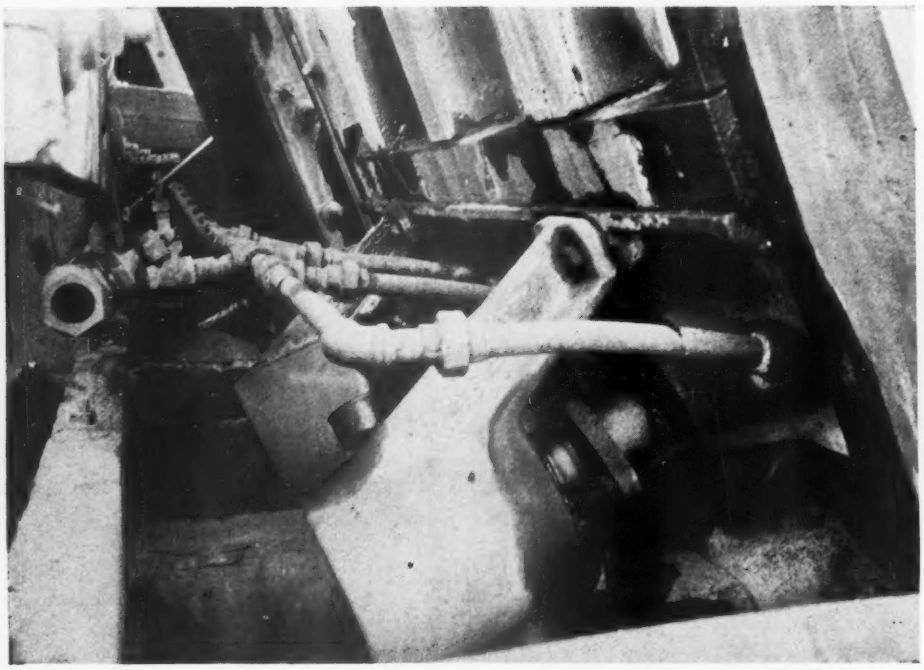
The lower conical screens have been fitted with a dust jacket which dewaters and removes sand to the sand drag, thus preventing overloading of the vibrating screens

Side view of movable dragline tower

Discharging the 1/8-in. to 1/4-in. material to waste piles



This pipe line is used for carrying 1/8-in. to 1/4-in. waste. For cleaning out the reclaiming tunnel a suction hose can be attached at point A



A water seal has been installed on the spiral conveyors. This has greatly increased the life of the packing gland and bearings

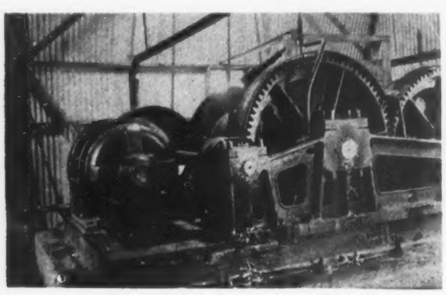
One of the two stationary masts at the ends of the dragline installation

The movable mast as seen from the stock pile

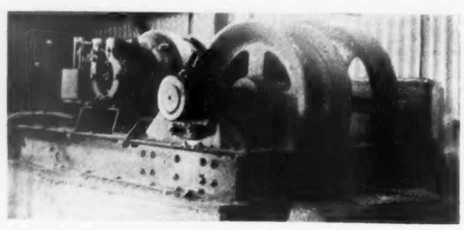
masts that are approximately 300 ft. apart. A ¾-in. steel cable, reaved as a 6-part line, spans these two masts, to which is fastened the tail sheave of the dragline. The tail sheave can be moved from place to place along the cable by two motorized winches, one at each mast, each electrically controlled.

At the opposite end of the stockpile from the dead end of the dragline is the two-drum Beaumont hoist, powered by a 150-hp. General Electric motor. The hoist is mounted near the base of a 65-ft. movable steel tower that rides two steel tracks, the tracks being approximately 25 ft. apart and 500 ft. long. The tower is moved along the track by a single drum hoist that has four wraps of ¾-in. steel cable, with the drum geared to a 15-hp. Lincoln "Line-weld" motor. The movement of the tower is controlled by a solonoid brake.

The drag scraper operates loaded at 300 ft. per min. and returns at 300 ft. per min.



The two-drum dragline hoist and motor



This electric winch moves the dragline tower

At left, a hand winch is used in connection with the stationary end of the dragline. Above is shown bucket crane used for widening a branch of the Des Plaines river which furnishes water for the plant

View of the Paul Ales plant, Material Service Corp., at Lockport, Ill., from the pumping station

The 4-yd. dragline bucket, as well as Jay Bohn, Rock Products traveler

with the longest haul being 500 ft. The entire installation uses 2500 ft. of 1⅛-in. and 500 ft. of ¾-in. Roebling steel cable. The steel was supplied by Joseph T. Ryerson and Sons, Inc. By the use of this drag scraper ground storage has been increased from 20,000 to 150,000 tons.

On the 42-in. loading-out belt from the stockpiles has been installed a model "E" Merrick Weightometer. The use of the weighing device prevents overloading the cargo boats and also gives a daily check on the tonnage shipped.

Water is supplied to the plant from the pumping plant through spiral pipe

The tunnel through which the 42-in. belt passes also acts as a drain for the water in the stocked material and at times, due to belt loading spillage, it becomes necessary to clean out the tunnel. They do this by sluicing the debris to a sump near the 8-in. Morris, waste-sand pump; and by connecting a short suction line to the sand-pipe suction the material is pumped to waste. Mr. Herkel, who has had many years' experience in the crushed-stone industry, says that the economies to be had by the use of pumps and their simplicity for elevating and conveying some of the smaller sizes of stone in that field is overlooked. His later experience in the production of sand and gravel lends weight to this opinion.

Considerable tonnage of material is shipped to local points by truck. The sand and pea, also No. 8, gravel are loaded by simply backing the truck into a tunnel constructed under the ground storage piles and loading direct from chutes. No. 6 is loaded to trucks by Barber-Greene loaders. No. 9 gravel is conveyed to a bin alongside of the 4-in. Symons crusher for loading to trucks.

There have been no radical changes at the crushing plant. Minor changes were the re-

Sand and gravel are weighed on this device as they pass to the boot

A 3-yd. steam chain bucket handles the raw material, much of which is of large size

Mounting of movable tower, showing cable-carrying arrangement

placement of the bar grizzly at the primary crusher feeder by a 4-in. stationary manganese steel screen. The new screen will outlast several bar grizzlies, it was said.

A 24-in. belt conveyor has also been installed so that the larger sizes of gravel from the stockpiles can be elevated and conveyed back to the two Symons disc crushers and reduced to finer sizes. This conveyor gallery, in keeping with the balance of the plant, is of steel construction, uses a Hewitt Gutta Percha belt that rides on Stephens-Adamson carrier and return rolls which are Alemite lubricated.

In the pit the 15-yd. Western cars used are all being provided with steel, reversible sides, replacing wooden sides that were heavily reinforced. A new 4-yd. Monighan dragline will soon be ready for loading as the pit was the "bottle neck" of this operation, and this addition is expected to bring the plant up to a capacity of 800 tons per hour. The dragline will work in conjunction with the 70-C Bcuyrus steam shovel previously used. It has been demonstrated that the plant can easily handle that tonnage provided the pit can make deliveries. Locomotives and cars are in readiness for handling the increased tonnage.

This increase in tonnage called for more wash water, so another 8-in. Gould centrifugal pump has been installed. This brings the total number of pumps up to four. Each is direct-connected to a 125-hp. Allis-Chalmers motor. The pumps deliver a total of 8000 g.p.m. to the plant through an 18-in. American spiral pipe.

Transportation has been speeded up and systematized so that a train of six cars arrives at the plant every 12 minutes. When the new shovel is at work this time will be cut in half. The unloading has been worked out so that the steam locomotives do not stop as they pass the crusher feed hopper; one man dumps the cars and one attends to the refastening. The single track passing the dump hopper has a slight dip away from the dumping side so that the empty cars are righted to the loading position without assistance. The old cars are counterbalanced with steel rails to further facilitate this operation.

A new repair shop has also been constructed.

Henry Crown is president of the Material Service Corp.; Irving Crown is vice-president and treasurer, in charge of all the company's operations, and G. W. Lenzie is general superintendent. Paul Ales is general manager of the Lockport plant, and F. W. Herkel is superintendent.

The 15-yd. cars are being equipped with reversible all-steel sides

New bunkers for loading direct from the plant or from stock piles is a novel addition to Material Service improvements

Brunswick, Ga., Cement Products Plant Has New Operator

R. L. BARNES, formerly of Fitzgerald, has closed a lease for the plant of the Southern Cement and Stone Co., located at the corner of Albemarle street and Cochran avenue, Brunswick, Ga., and he has already started it in full operation. During the past few days the machinery and equipment has been gone over and repaired and the plant started.

Mr. Barnes, previously engaged in the contracting business, has had previous experience in such a plant. After looking over the situation he decided that Brunswick was undoubtedly a good field for such an industry and negotiations opened for the plant were closed several days ago. Everything of cement will be manufactured, including flower pots, garden benches, paving and building blocks, all kinds of contractors' supplies, etc. Mr. Barnes stated yesterday that already he was negotiating for a number of large orders.

The plant of the Southern Cement and Stone Co. has been closed for the past few years. Several years ago it manufactured all of the cement blocks used in a big project of sidewalk paving in Brunswick. It is a well equipped plant, and the new lessee plans to add some new and modern machinery and he has already engaged the services of an experienced mechanic to act as superintendent of the plant. Mr. Barnes announces that his family will shortly join him here.—*Brunswick* (Ga.) *News.*

The "Missing Link" in Concrete Aggregate

Failure to Consider Both Fine and Coarse Aggregate as a Unit Ingredient of Concrete Has Befuddled the Discussion of Aggregate Characteristics

By Leroy C. Gilbert, C.E., Assistant, and Herbert F. Kriege, Ph.D., in Charge
The France Stone Co. Laboratories, Toledo, Ohio

NUMEROUS AGENCIES are contributing to the advance of knowledge in the field of concrete. The groups interested in the production of cement, coarse and fine aggregates, admixtures, etc., have vied with those engaged in the engineering phases of concrete practice in helping to gather data and establish relationships which have brought us into new conceptions of the use and adaptability of concrete.

Within the past few years the Bureau of Public Roads has set forth a few guiding principles toward improved practices in building concrete roads. One of these encourages the substitution of proportioning concrete by weight for the volume method. Another recognizes the value of reducing the water content of the mix to its lowest practical point. A third covers the abandonment of hand-finishing methods for machine finishing. A fourth deals with the gradation of aggregates in the following words: "the scientific grading of coarse aggregate by combination of separated sizes in each batch in the proportions which will produce the maximum practical destiny."[1] This last mentioned subject of the proper grading of the material into the fine, coarse and combined aggregate, will receive our attention at present.

Voids

A great deal has been thought, said and written about the voids in aggregates as affected primarily by their gradation. The attention has been focused principally on either coarse aggregate or the sand fraction. Occasionally an engineer voices a desire for the densest possible aggregate, either separate or in the combined state, for his next concrete job. Without malice of forethought, that sounds like a very logical and progressive idea. However, meditation upon these things may show certain dangers not obvious at first thought.

Not long since, A. T. Goldbeck[2] published an interesting article on the "Effect of Gradation of Crushed Stone on the Percentage of Voids." In this investigation he used broken stone screened into three sizes—⅛-in.-¾-in., ¾-in.-½-in. and 1½-in.-2½-in., each separate having a straight line gradation within itself. It was found that the voids could be reduced to 33.9% in the compacted state and 38.6% loose volume, by the combination of the ⅛-in.-¾-in. and 1½-in.-2½-in. fractions in equal quantities, omitting all intermediate material. This low voidage compares very closely with that of gravel aggregates of the usual gradations.

The statement is made in this paper that "no doubt a still lower percentage of voids could be produced by special gradation of the three sizes used, but this would be a rather difficult procedure from the operating standpoint and the slight decrease in voids which might thus be obtained would probably not warrant the extra cost involved." Disregarding the economic phase of the subject it is interesting to see what this effect of gradation on voids will be when the plan followed by Goldbeck is carried a step farther.

> ### Editor's Note
>
> ***NO PRODUCER OR USER of aggregates should fail to absorb this article. If he will, it may change his point of view regarding current controversies about the characteristics of concrete aggregates.***
>
> ***The authors show that failure to regard aggregate in its entirety, as a concrete-making ingredient, is responsible for much of the difference of opinion that exists regarding the concrete-making properties of various kinds of aggregate.***
>
> ***The authors show that the "missing link"—aggregate between 3/4-in. and 10-mesh sizes—is responsible for as much variation in concrete strengths as are variations in types of aggregates.***
>
> ***The attempt to draw a definite line of distinction between fine and coarse aggregates has resulted in the aggregate as a whole being deficient in the "missing link" sizes. Because of the nature of the material, gravel is more apt to have these sizes than crushed stone or slag, as ordinarily specified.***
>
> ***—The Editor.***

Several years ago there were begun in the France Stone Co. laboratories some investigations in this matter of gradation and voids. While both fine and coarse aggregates were studied, only the latter will be considered at present. Instead of taking the range 2½-in.-⅛-in., as Goldbeck did, we used slightly lower limits, namely, 2-in.-8-mesh sieve. Instead of the three separates (round openings)—2½-in.-1½-in., 1½-in.-¾-in. and ¾-in.-⅛-in., we sieved the following fractions: 2-in.-1½-in., 1½-in.-1-in., 1-in.-¾-in., ¾-in.-½-in., ½-in.-¼-in. and ¼-in-8-mesh. The chief difference in our work was narrowing the size limits of the fractions, particularly with the smaller material. The voids of several combinations of these fractions are shown in the accompanying chart, Fig. 1, including the lowest voids obtained by Goldbeck on similar material. It will be seen that the void reduction increases rapidly as the size of the smaller fraction combined with the 2-in.-1½-in. material is decreased. Thus a voidage of only 32.1% is obtained with equal parts of 2-in.-1½-in. and ¼-in.-8-mesh in the compacted state, these being the largest and the smallest sizes, respectively. It seems reasonable to assume, then, that even lower voids would result if the two combined fractions differed still further in size. This assumption will later be shown to be correct.

Most of us would quickly reject a coarse aggregate composed of 50% 2-in.-1½-in. material and 50% ¼-in.-8-mesh, yet this is a mixture having very low voidage. Is it possible that our quest for a low voidage coarse aggregate may lead us into a practical absurdity? It is.

Continuing the discussion of Goldbeck's paper we find that even though the lowest voids were produced by combinations of the end members with none of the intermediate members of his series, voidages nearly as low were obtained with mixtures containing as much as 40% of the intermediate (¾-in.-1½-in.) stone. Thus the straight line grading from 2½-in.-⅛-in. gave 35.0% voids compacted and 39.7% loose. Since it happens that all the sizes of stone coming from the crushing operation at the plant more or less stimulate a straight line grading from coarse to fine, the voidage of such a gradation would be only 1-2% greater than the densest mix Goldbeck found. Even if we desired this densest aggregate grading produced by omitting the intermediate sizes, there would be weighty economic reasons mitigating against it. Now let us see if we want this densest aggregate for concrete. Perhaps this oft repeated desire is more of a notion than a need.

Last year Goldbeck[3] reported the results of tests of concrete made from various combinations of stone sieved into these portions—2-in.-1¼-in., 1¼-in.-½-in., ½-in.-4-mesh. The values obtained should be of real interest to engineers trying to relate aggregate characteristics with concrete quality. While no startling differences in strength values

[1] *Crushed Stone Journal,* Nov., 1928, page 5.
[2] *Crushed Stone Journal,* Nov., 1928, pages 1-5.
[3] *Crushed Stone Journal,* April, 1929.

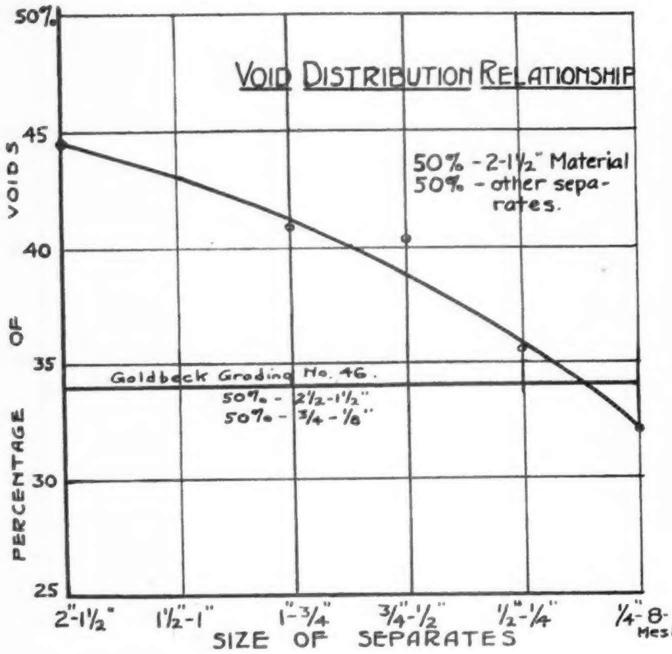


Fig. 1

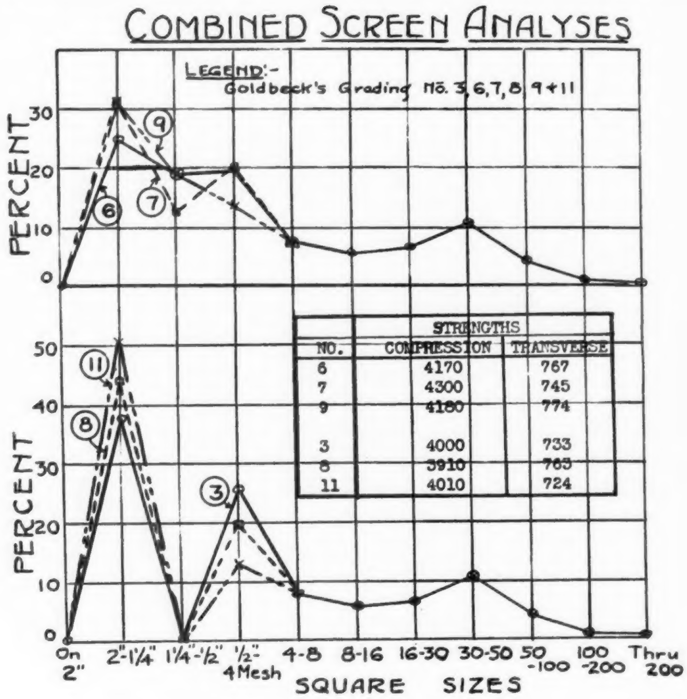


Fig. 2

were observed, out of the twelve combinations of sizes used the three "gap gradings," i. e., having no intermediate material, ranked tenth, eleventh and twelfth in compressive strength, and fourth, seventh and ninth in transverse strength. In contrast to this slump in the relative strength of the concrete, the coarse aggregates containing 20-30% of the intermediate size and somewhat approximating the straight line grading, ranked first, second and third in compressive strength and second, third and sixth in transverse strength. Although the data are not numerous, the tests were carefully conducted, and give rather strong evidence against the use of low voidage coarse aggregates produced by "gap gradings." The author states —"that a considerable percentage of intermediate size material may be used in coarse aggregate without increasing the percentage of voids more than a few percent and without appreciably altering the cement factor or concrete strengths." It seems that the author would have been justified in stating his conclusion a little differently, perhaps in these words—"gap grading" reduced the voids of the coarse aggregate only 1 or 2%, but it reduced the transverse and compressive strengths of the concrete to a greater extent and hence is not a desirable condition.

The chart, Fig. 2, consists of the graphic presentation we have made of the distributions of the various sizes of material used in Goldbeck's investigation. A few statements should be made in explanation of this chart. On the horizontal axis are shown the usual *individual* sieved fractions of the combined aggregate from 2-in. down to 200-mesh, spaced equally without regard to their actual difference in dimensions. The ordinates represent the percentages of each of the several sizes of material used in the *combined aggregate*. Thus the curve of aggregate No. 8 is shown to have the following distribution of sizes: 0% on 2-in., 44% between 2-in. and 1¼-in., 0% between 1¼-in. and ½-in., 20% between ½-in. and 4-mesh, 8% between 4- and 8-mesh, etc. The sum of all the ordinates forming one curve is 100. The curves are drawn to connect the points consecutively and thus aid the visual inspection of the distribution of the sizes in the aggregate.

It will be seen that three of these distribution curves (Nos. 3, 8, 11) show zero readings of the 1¼-in.-½-in. size. These are obviously the three "gap gradings" used. These gradings are conspicuous because of the extreme high and low points on the curves. We have found no other graphic presentation that shows so clearly just what such a gap as this omission of intermediate material introduces into the distribution curves. When one has a clear conception of what the appearance of the distribution curve of a well graded aggregate should be, it is very easy to locate the points of deviation from this curve and know how to remedy them. As much cannot be said of several other forms of graphic presentation quite widely used today. This is particularly true of those forms dealing with accumulative values instead of individual ones. These are more like the fineness moduli which tell us the final summation of values without stating which of a multitude of devious ways were followed in obtaining those sums.

Fine Aggregate

Let us now turn to the question of gradation of the fine aggregate in relation to its merits when used in concrete. Such properties as surface characteristics, angularity, and interstitial spaces must play a part in the cementation process of concrete formation. Hence, we may well except the virtues and the vices of the fine aggregate to overshadow those of the coarse aggregate by reason of the much greater area of contact with the cement.

W. H. Smyers[4] reported last year on the effect gradation has on the voidage of fine aggregate. Using three fractions of crushed blast furnace slag—4- to 8-mesh, 8- to 14-mesh and 14- to 28-mesh, Smyers found that the greatest void reduction resulted from 50-50% combinations of the 4- to 8-mesh and 14- to 28-mesh, omitting the intermediate size. Under his conditions of test the voids were reduced to 30.7%. Again, as in the case of Goldbeck's investigation with coarse aggregates, a suggestion is made or implied regarding a method of reducing aggregate voidage, which is not bad as far as they have carried it, but which will lead into a serious fallacy for concrete purposes if carried to its logical conclusion. Thus, in the case of the fine aggregate, if Smyers had chosen fractions more widely separated in size than 4- to 8-mesh and 14- to 28-mesh, say 4- to 6-mesh and 48- to 100-mesh, he would have observed even larger void reductions. In support of this statement, let us examine charts, Figs. 3 and 4, which contain some data from an investigation of void-aggregate distribution relationships begun two years ago in our laboratory.

In these charts we find the effect of increasing the difference in the size of the end members of a series upon the voids in their combined compacted state. The percentage voids are given not only for 50-50% combinations but also 10% and 25% of the smaller material to 90% and 75%, respectively, of the coarser sizes. Again, the 50-50% combinations prove densest. The rather regular increase in density of the combinations is obvious as the end members become more widely separated in size.

[4] *Concrete*, April, 1929, 21-23.

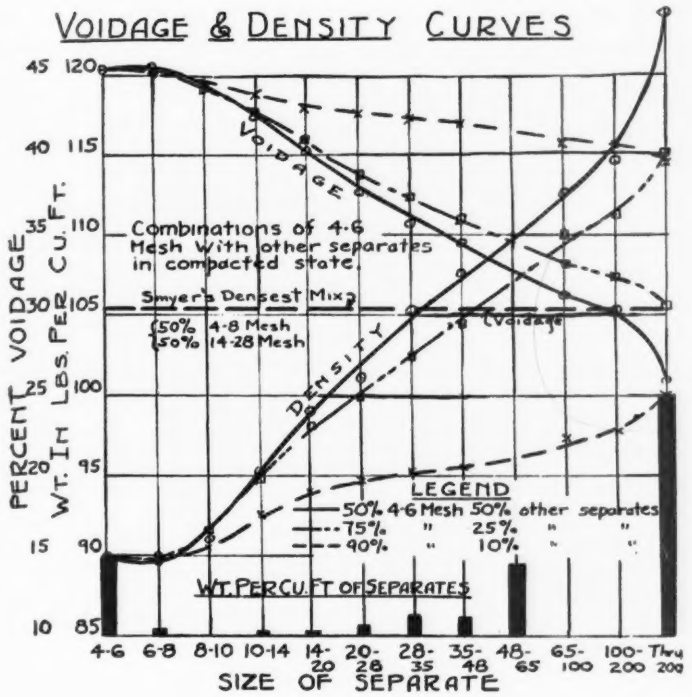


Fig. 3

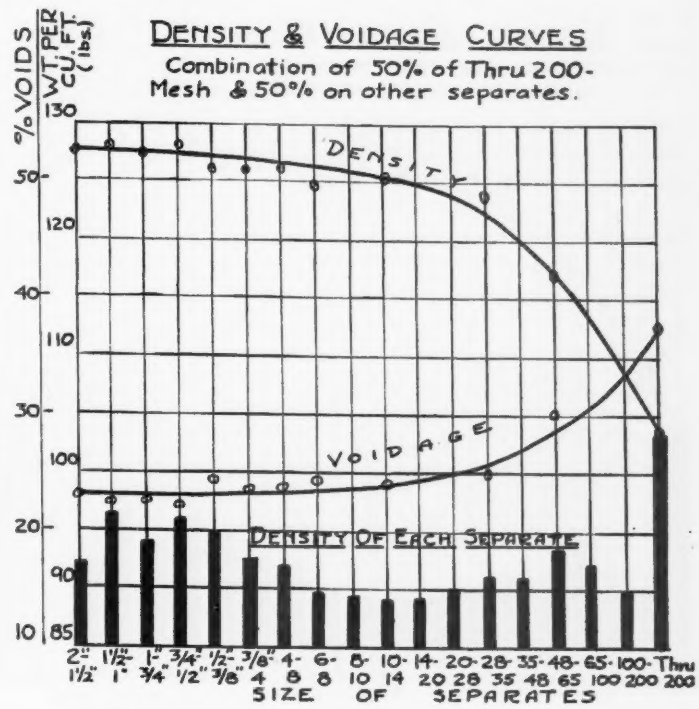


Fig. 4

The densest mix of these series is one composed of 50% 4- to 6-mesh and 50% below 200-mesh material. A slightly lower voidage, not shown on the chart, can be obtained by combining equal parts (33⅓%) of 4- to 6-mesh, 20- to 28-mesh and below 200-mesh material. Even though these artificial sands have respectable fineness moduli, namely, 2.50 and 2.67, respectively, and are clean and produce fair workability, I dare say that scarcely an engineer would permit their use in any important work under his supervision. Which then do we want—an aggregate having low voidage produced by "gap gradings" and excessive amounts of dust or one having a good distribution of all the sizes and slightly greater voidages?

Not many reliable data have been published to show just how seriously "gap gradings" in sands affect mortar and concrete strengths. Our own tests have been too few to more than indicate that the reduction in strength is great enough to warrant avoiding any such combinations designed to give low aggregate voidage. H. F. Gonnerman[5], writing on a slightly different phase of this subject, emphasizes the importance of size and gradation of sands for concrete in a recent discussion of extensive tests of the Research Laboratory of the Portland Cement Association. Data were given showing "that for fixed proportions and slumps, an improvement in size and grading of the fine aggregate may increase concrete strength as much as 100%." Experience has taught us to avoid any fine aggregate having excessive amounts of very fine particles. Certainly these densest sands discussed in the preceding paragraph contain excessive amounts (33⅓-50%) of material finer than the 200-mesh sieve.

Effects of "Gap Grading"

Thus far we have treated the matters of gradation and voids in the coarse and fine aggregates separately. The undesirability of gaps in the distribution curve of either has been pointed out. It now remains to learn what effect similar irregularities may have on the resultant concrete if they occur in the combined aggregate curve.

We find ourselves today in the rather queer position of having arbitrarily put asunder what in Nature is united. Gravel deposits are usually associated with sand in a fairly good proportion. The crushing operation of stone and blast furnace slag produces somewhere near the right amount of intermediate material to make a properly graded aggregate. Yet we have separated the fine from the coarse portion so definitely and drawn the line of demarcation so sharply that undoubtedly more aggregates are rejected by inspectors because they slop over this specified line than for any other reason. How many specifications have you seen lately covering general concrete aggregates which will permit more than 10% of sand above the 4-mesh sieve or ¼-in. screen or more than 15% of stone, slag, or gravel below the same limit? The highway specifications of only four states in the Union are permitting sand gradations like that. Another coarse grading is permitted in the A. S. T. M. tentative specifications C 33-28T[6], which allows fine aggregate to carry 0-15% material coarser than the 4-mesh sieve. Some heroism was displayed when these specifications were written in the face of the usual type encountered for concrete fine aggregates.

The Missing Link

This very rigidity regarding the dividing line between the arbitrarily set fine and coarse fractions has compelled the producers of all aggregates to avoid coming too near this line with either the coarse or fine material. As a natural result there is usually a lack of particles of about ¼-in. size in the aggregates when they are combined. Here we find a link missing. This is a condition which has economic as well as technical importance. We may find it profitable to ask if this is a desirable condition in the light of the best information now available.

In the first place, let us consider what effect a deficiency in the marginal material (about ¼-in. size) has on the voidage of the combined aggregate. A void *increase* in the coarse and in the fine aggregate separately takes place with, however, a void *decrease* in the combined aggregate. This is entirely in accordance with the data given previously for each portion of the aggregate separately. By increasing the gap further, say to exclude ¾-in.-14-mesh particles, the voidage of the total aggregate is further reduced. Again we find that the wider the gap between the end members, the greater is the density of their combination. Chart, Fig. 4, gives at a glance the effect of the widened gap on the voidage of a combined aggregate. No one is interested in using such aggregates in concrete as the densest combinations shown consisting of 50% 2-in.-1½-in. and 50% below 200-mesh material. Again we are made conscious of the fact that great density in the combined aggregate is not the highest virtue. Fallacy lies too near the beginning

[5] Proceedings A. S. T. M., Vol. 29, Part II, 754-73 (1929).

[6] Proceedings A. S. T. M., Vol. 28, Part I, page 822 (1928).

of this road of "gap grading" to make extensive travel down it safe.

Conclusions About Voids

Before leaving the subject of voids, fine, coarse and combined aggregates alone (without cement and water) as controlled by gradation, let us restate, as concisely as possible, the relationships previously known or demonstrated in this discussion to exist with materials ranging from 2-in. to 200-mesh in size:

(1) The more nearly uniform the size of particles in an aggregate, the greater is the voidage or interstitial volume of the aggregate composed of these particles.

(2) When two aggregates of the same general shapes but of different sizes are combined in several proportions, the greatest void reduction occurs with approximately 50-50% combinations.

(3) The more widely the two fractions to be combined differ in size, the greater is the void reduction. Thus a mixture of approximately 50% 2-in.-1½-in. aggregate with 50% below 200-mesh material is the densest observed mixture of any two separates between these two extremes.

(4) As the "gap" between the coarse and fine aggregates is increased, the voidage of each portion *increases* while the voidage of the combined portions *decreases*. Thus the separate portions 2-in.-1-in. and 28- to 100-mesh particles have higher voidage than 2-in.-½-in. and 8- to 200-mesh particles respectively. However, the voidage of the 2-in.-1-in. and 28- to 200-mesh sizes *combined* is less than that of the 2-in.-½-in. and 8- to 200-mesh sizes *combined*.

(5) When more than two fractions are mixed, the lowest voidage results from the combination which provides sizes of particles just fitting into the voids of each larger fraction or combination of fractions. With spheres of unit diameter, the next smaller separate which can be used to just fit without crowding into the interstices is 0.414 units in diameter.

* * * * *

An Independent Study of Aggregate Characteristics

Two years ago an investigation was undertaken in the France Stone Co. laboratories to determine the relative merits of slag and stone as concrete aggregates when compared with gravel. The word was beginning to be heard generally that the specific properties of each type of aggregate produced quite a profound difference in certain qualities when made into concrete, particularly affecting the flexural strength. Such characteristics as angularity, shape and elongation of aggregate particles, govern to a certain extent the strength of the resultant concrete. With no other thought in mind than that of seeking first-hand information regarding the comparison of our materials as produced with those aggregates they met competitively, the following investigation was carried out.

The Michigan State Highway Department had recently shown that concrete could be proportioned on a mortar-void basis so that practically the same compressive and transverse strengths were developed in concrete containing the same cement content but made of aggregates of different types. This plan was followed in our research since it was so evidently ahead of the common practice of arbitrary volume or weight proportioning. The method uses as its basis the weight per cubic foot of the coarse aggregate as received on the job, the amount of fine aggregate required to produce a certain volume of concrete being determined by the voidage in the coarse aggregate. A chart based on the characteristics of the aggregates to be used is made up for each job, so that the weights of coarse aggregate, sand and water necessary to produce a cubic yard of concrete with six sacks of cement can be read off directly. A typical chart showing the salient features of this method is Fig. 5. The distinct advantage of this plan of proportioning is that one can maintain a practically constant yield or uniform cement content in the finished concrete, regardless of the type of aggregate used. This was a particularly desirable feature for our comparative study.

Three Michigan gravels, one blast-furnace slag, and stone from seven of the Indiana, Michigan and Ohio quarries belonging to the France Stone Co. were the coarse aggregates selected. As fine aggregates, three Michigan bank sands, slag screenings (¼-in.-0) and our washed limestone sand were used. The quantity of concrete made up for each test batch was about seven cubic feet, the constituents being weighed into a two-bag mixer, mixed for two minutes, and the consistency determined by the slump test. The slump was kept between 1-2-in. for each batch. The fresh concrete was then made up into six beams for transverse testing (6-in. x 6-in. x 44-in.) and in six compression test cylinders (6-in. x 12-in.). The concrete specimens were cured in air for one day and then in moist sand until the time of testing. The curing conditions were practically like those in the field except for the direct sun's rays, as our specimens were stored in a shed with practically open sides.

The compression tests were made at 7 and 28 days, three cylinders being broken for each batch at each of these ages. The trans-

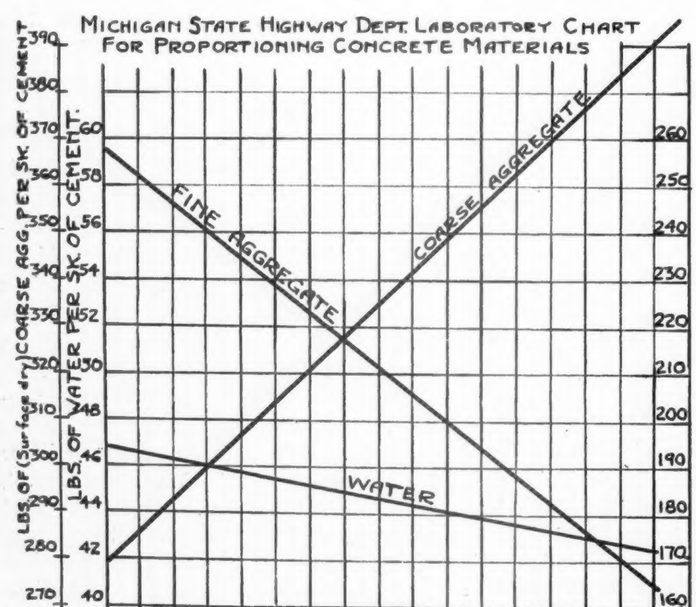


Fig. 5

Average Grading	Transverse					Compression	
	7	14	28	3 Mo.	6 Mo.	7	28
Smooth	542	618	720	924	899	2796	4182
Fair	511	598	685	884	950	2317	3870
Gap	509	584	669	805	755	2212	3277
Excess	522	638	750	778	837	2296	3517

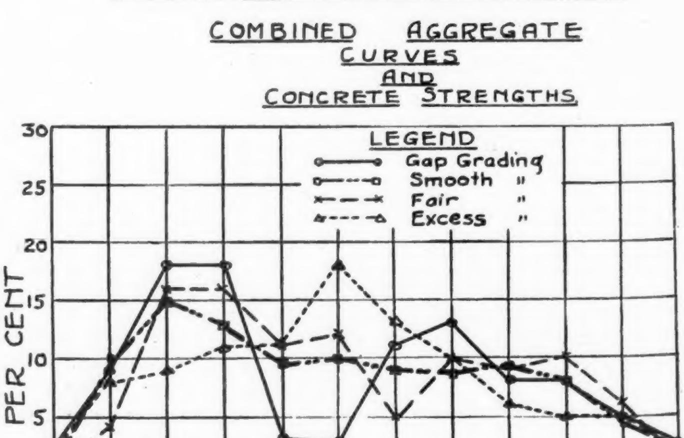


Fig. 6

verse beams were broken at 7 days, 14 days, 28 days, 90 days and 180 days. The sixth beam was saved for testing on any day when an irregularity appeared in the breaks of the other beams. Each of the transverse beams was long enough to be broken three times. Hence the values given for the transverse tests are the averages of three breaks each, at least, and in some cases six. These beams were broken on a machine belonging to the Ohio State Highway Department, used through the courtesy of the Lucas County Laboratory. All other determinations as the compressive strengths, weights per cubic foot of concrete, screen analyses of aggregates, actual cement content, etc., were made in our own laboratories.

The results of the investigation are shown in the accompanying tables.

It will be noted from the tables that considerable variation was found in the strength of the concrete specimens even though the cement content was constant.

In Table 3 the average values as well as the extremely high and extremely low values of each type of aggregate will be found. It is well to keep in mind that a single stone of inferior quality may have produced practically all of the low values, likewise a poor gravel contributed practically all of the lowest values shown. These facts are mentioned so that it will be understood that the values both high and low have not been arrived at from eccentric conditions in the experimentation but rather represent real variations in the aggregates.

It will be remembered that a constant cement content was used in the chief part of this investigation, namely, six sacks per cubic yard, determined by carefully weighing out the constituents and measuring the yield of concrete. Those batches containing seven sacks per cubic yard of concrete have been calculated to the same cement factor in some of the comparisons with the batches made up with six sacks per cubic yard.

In addition to careful batching and yield measurement, the actual cement contents of numerous concrete specimens containing stone and gravel were determined after they were broken for compressive and transverse strength. The method used was one described by one of the authors[7] some six years ago. (Slag concrete does not lend itself to this procedure of analysis.) In this way irregularities between the members within certain series could be accounted for in most cases. It was found that even with more than usual care in the mixing and later handling of the concrete, the cement content of one cylinder or beam could be 12.5%, while its neighbor had 14.0%. Differences in the compression strengths of 200-500 lb. per sq. in. were produced by these variations in the percentage of cement present. With attention directed to this lack of uniformity in the cement content of our specimens still greater care was exercised in keeping the wet concrete mass alike in every form until there was very

[7] Kriege, *Eng. News-Record* 92, 892-3 (1924).

TABLE 1. TRANSVERSE AND COMPRESSIVE STRENGTH TESTS
Six sacks per yard batch:

Aggregates	Transverse 7 da.	14 da.	Average of 3 each 28 da.	3 mo.	6 mo.	Compressive average of 3 each 7 da.	28 da.	Total water-cement ratio	Yield in cu. ft. per sack cement
				Stone					
A-I	667	705	712	942	1022	2863	2833	.832	4.23
B-V	542	597	667	823	1078	2946	4487	.797	4.27
B-II	540	645	648	780	860	2293	3907	.968	4.70
C-IV	537	663	812	948	1093	2448	3993	.912	4.47
C-II	498	662	790	947	942	2080	3318	.816	4.50
D-I	545	618	878	1057	857	2905	4737	.902	4.50
E-I	453	512	553	888	788	2079	3967	.899	4.67
D-I	495	695	747	....	....	2053	3870	.766	4.30
G-I	513	623	787	1138	860	2867	5033	.730	4.40
I-VII	585	640	840	....	....	3218	4667	.840	4.26
Average	537	636	743	940	938	2575	4081	0.846	4.43
				Gravel					
1-I	573	702	710	963	888	3098	4236	.743	4.53
1-II	525	543	725	920	803	2568	3667	.793	4.37
2-IV	425	528	600	620	766	1443	2331	.718	4.30
2-II	580	723	772	767	802	2442	3753	.778	4.60
3-V	545	595	660	875	988	2522	3787	.767	4.47
Average	530	618	693	829	849	2415	3555	0.760	4.46
				Slag					
AA-IV	517	557	558	595	725	2349	3478	.943	4.33
AA-II	492	620	673	720	760	2275	3318	.903	4.60
AA-I*	560	623	705	980	735	2223	3413	.918	4.67
AA-I	482	582	777	1068	875	2410	3627	9.69	4.60
AA-VIII	492	543	630	663	680	1805	2547	1.024	4.53
Average	509	584	669	805	755	2212	3277	0.951	4.54
				Mortar					
-VI	302	507	592	....	....	940	1816	.870	4.20
H-VI	324	609	620	....	....	1236	2443	.872	4.07
-VIII	449	652	715	....	....	2028	2953	1.010	4.73
Average	358	589	642	....	....	1401	2404	0.917	4.33

* Over-sanded 10% more than its requirement.

TABLE 2. TRANSVERSE AND COMPRESSIVE STRENGTH TESTS
Seven sacks per yard batch:

Aggregates	Transverse 7 da.	14 da.	Average of 3 each 28 da.	3 mo.	6 mo.	Compressive average of 3 each 7 da.	28 da.	Total water-cement ratio	Yield in cu. ft. per sack cement
				Stone					
A-III	615	645	807	1028	1075	3123	4210	.746	4.57
D-2/31V & 1/3V	520	648	852	1005	1017	3133	3667	.698	4.77
D-I	515	680	842	1102	982	2070	4407	.717	4.60
G-I	622	727	800	1102	1005	2447	4713	.623	4.60
Average	568	675	825	1059	1020	2693	4499	0.696	4.59
				Gravel					
1-I	640	735	788	995	1035	3693	4787	.636	4.57
3-2/31V & 1/3V	612	613	762	963	845	2900	4353	.671	4.80
Average	626	674	775	976	940	3297	4570	0.654	4.68

TABLE 3. AVERAGE VALUES FOR VARIOUS TESTS AND AGGREGATES

	7 da.	14 da.	28 da.	3 mo.	6 mo.	Compression 7 da.	28 da.	Total water-cement ratio	Yield in cu. ft. per sack cement
Stone	537	636	743	940	938	2575	4081	.846	4.43
Gravel	530	618	693	829	849	2415	3555	.760	4.46
Slag	509	584	669	805	755	2212	3277	.951	4.54
				Extremes—Lowest values					
Stone	453	512	553	780	788	2053	2833		
Gravel	425	528	600	620	766	1443	2331		
Slag	482	543	558	595	680	1805	2547		
				Highest values					
Stone	667	705	878	1138	1093	3218	5033		
Gravel	580	723	772	963	988	3098	4236		
Slag	560	623	777	1068	875	2410	2637		

TABLE 4. CONCRETE STRENGTH AND PERCENTAGE OF COMBINED AGGREGATE BETWEEN ¾-IN. AND 10-MESH IN SIZE

	Transverse (Modulus of rupture)					Compressive strength	
	7 da.	14 da.	28 da.	3 mo.	6 mo.	7 da.	28 da.
Group 1—10-20% (¾-in.-10-mesh)	541	615	686	865	840	2467	3489
Group 2—21-29% (¾-in.-10-mesh)	519	594	705	909	881	2650	4170
Group 3—30-35% (¾-in.10-mesh)	513	609	705	890	862	2371	3855
Group 4—36% or over (¾-in.-10-mesh)	522	638	750	778	837	2296	3517

	No. of various aggregate mixes per group	Average content of ¾-in.-10-mesh material
Group 1	6	14%
Group 2	7	24%
Group 3	9	31%
Group 4	4	44%

fair uniformity of the compression results and of cement content as determined chemically. Therefore, with uniform cement content, mixing and consistency, this comparison of the aggregates is as nearly as possible on the *same basis.*

Reasons Sought for Different Concrete Values

We are interested at this time less in the comparative values obtained with gravel, slag and stone in these tests than in the reason for the observed differences. Thus, we need some explanation for certain notable exceptions in each type of aggregate from the average of that group. Certainly we must find some reason for the unexpected lower strengths developed by the concrete containing slag.

The usual leads, such as net water-cement ratio, voids, and workability, were followed for some apt explanation but with no success. These were not disturbing factors in our series of tests. The cement content even though doubly checked, left unaccountable differences in the strength. The properties of both coarse and fine aggregates were well within the usual state highway specifications and hence should not have been responsible. Finally it was noted that the distribution curves of the combined aggregates grouped the mixes into rather well defined classes. Several relationships between the curves of these groups and their strength values are evident. The first was that practically all of the mixes giving unexpectedly low results had distinct deficiencies or gaps in the material between ¾-in. and 10-mesh size. This was particularly true with the slag batches. This same slag gradation was being used for concrete base construction by a local paving contractor who requested a size of 2-in.-¾-in. with as little fine material as possible. No sand used in our tests with the slag happened to contain a large enough quantity of coarse material to rectify this condition. Hence all the mixes containing slag were sadly lacking in material of the marginal zone—¾-in.-10-mesh sieve. Another group showing a very smooth distribution curve across this zone gave consistently high strengths. Others with deviations both above and below this curve gave interesting variations in strengths. We were forced, then, to accept the importance of having present the right amount of material between ¾-in. and 10-mesh size.

Since it is easier to follow the effects of these gradation differences with the aid of charts and tables, we will refer to them.

In Table 4 are given the relationships which we have observed between the percentages of the combined aggregate caught between the ¾-in. screen and the 10-mesh sieve and the concrete transverse and compressive strengths.

Not quite the same arrangement of the mixes has been used in the table as in the chart, Fig. 6. Also there is not as much difference in the values of the numerical groups as in those shown graphically. The reason is that certain mixes were not considered good grading because of peaks and valleys in their distribution curve and were classified as "fair" instead of "good," even though they had a sufficient quantity of material passing ¾-in. and retained on the 10-mesh sieve. This shows that the quality of the concrete as measured by compressive and flexural strength is more accurately judged from the distribution curves of the combined aggregates than from their sieve analysis. However, numerical values are easy to keep in mind and hence should be given their full credit in any discussion.

Table 5 gives some of the average strength values developed when the 20 mixes of uniform cement content are arranged in order of their increasing percentages of combined material smaller than the 10-mesh sieve.

Difference in Grading Chief Characteristic of Aggregate

Apparently, then, the *total quantity* of this smaller fraction (passing 10-mesh) has been of less importance than the fraction between 10-mesh and ¾-in. This in spite of the fact that five kinds of fine aggregate were used and in quite different proportions with the several types of coarse aggregate. It should be stated that gravel, slag and stone have intermingled shamelessly in the grading groups and have contributed good and bad to every classification. *Only by the difference of grading was any one aggregate type characterized as such* and in that case it happened to be slag. That is, all specific characteristics of aggregate types, whether gravel, slag or stone, were overshadowed by the effects of gradation.

We have indicated now that the reduced strength of the slag concrete mixes was due to the missing link of the combined aggregates. The burden of proof that the *presence* of this intermediate size material would definitely benefit these concrete masses still lies with us. To this end we wish to present the results of several laboratory designs of concrete and of their practical application on various construction jobs.

The first mix was made up with a definite break in the distribution curve in the intermediate sizes. Chart Fig. 7 shows both the combined aggregate curves and the strength values obtained. Evidently this supports the contention that closing the gaps in the slag aggregate was helpful. Also that an excess of this intermediate material gives better concrete strengths than a deficiency of that size.

In another instance a contractor putting in a concrete pavement base called for 2-in.-¾-in. crushed blast-furnace slag to be used with a rather fine river sand (fineness modulus 2.2-2.55). During the early course of construction rather low compressive strength was obtained. On the nominal mix 1:3:5, the 7-day values were 700-750 lb. per sq. in. and the 28-day compressive strengths were just meeting the 1500-lb. requirement. Since no change in the sand could be introduced, for economic reasons, we considered it necessary to improve the grading or distribution of the combined aggregate by admitting considerable quantities of the finer sizes in the slag. The slag which had consisted of 75% (2-in.-1-in.) and 25% (1-in.-½-in.) was changed to contain 40% (2-in.-1-in.), 40% (1-in.-½-in.) and 20% (½-in.-4-mesh). The effect of this was to change the 7-day compressive values to 900-1000 lb. and the 28-day values to 1700-1850 lb. Thus a noteworthy strength increase resulted from grading the aggregate properly—i. e., bridging the gap.

Cost of the Missing Link

In order to determine what sacrifices of strength accompany the practice of omitting the finer fraction of the coarse aggregate from the distribution curve, the same aggregates used on the street job described above were investigated further in the laboratory. Six gradings were designed in which the material between ¾-in. and 4-mesh varied from 7.0%—28.5% of the total combined ag-

TABLE 5. EFFECT OF QUANTITY OF AGGREGATE PASSING 10-MESH SIEVE ON THE STRENGTH OF CONCRETE CONTAINING IT

No. of mixes averaged	Classified as group	Actual average per cent	28 day compressive	28 d. modulus of rupture
4	20-25%	22.4%	3658 lb.	711 lb.
4	25-30%	27.7%	3754 lb.	716 lb.
6	30-35%	32.8%	3952 lb.	724 lb.
6	35% and over	39.2%	3687 lb.	683 lb.

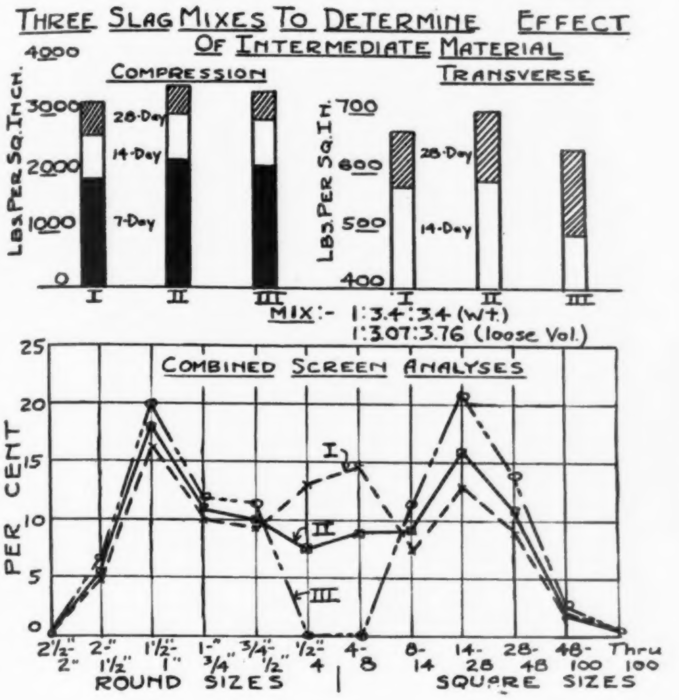


Fig. 7

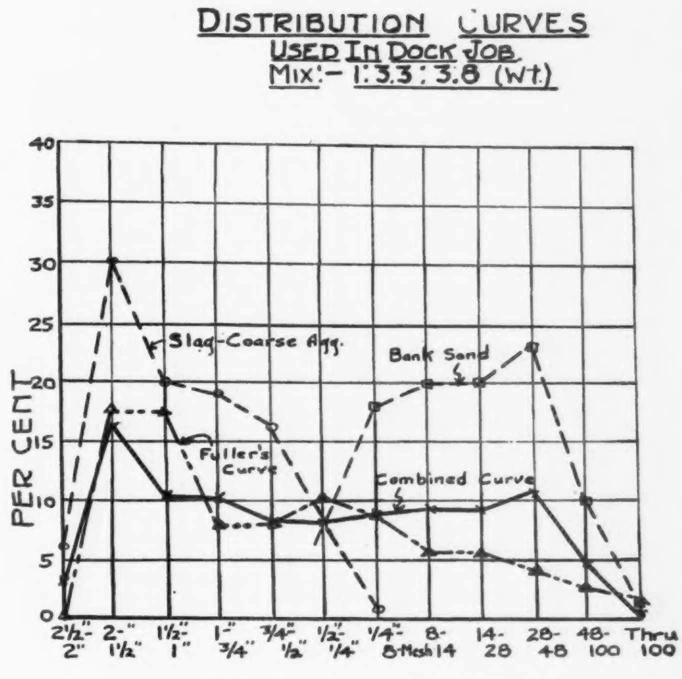


Fig. 8

gregate. The Michigan method of design was used to provide an equal cement content. Only a slight variation was found, 5.42-5.53 sacks per cu. yd. of concrete. One other mix (No. 8) was inserted which had the arbitrary 1:3:5 proportion, but in which the grading of the slag was like that of No. 7—i. e., containing considerable finer material. The compressive strengths and other data are given in the accompanying Table 6.

The screen analysis of the river sand was:

Through	On	
	4-mesh	9%
4-mesh	8-mesh	9%
8-mesh	14-mesh	9%
14-mesh	28-mesh	11%
28-mesh	48-mesh	32%
48-mesh	100-mesh	21%
100-mesh		9%

Through	On	
	4-mesh	9%
4-mesh	10-mesh	12%
10-mesh	20-mesh	14%
20-mesh	30-mesh	12%
30-mesh	50-mesh	25%
50-mesh	100-mesh	19%
100-mesh		9%

Fineness modulus, 2.53.

This is not a well graded sand, but had to be taken in this case for purposes of comparison. The need of a coarser sand is evident from the relatively low values of the

$$\frac{\text{compressive strength}}{\text{cement factor}}$$

TABLE 7. GRADATION OF SLAG AND SAND FOR TOLEDO DOCK WORK

Slag Round opening		Sand		Combined (1:3.3:3.8 by wt.)	
2½-2-in.	6%	On 4-mesh	8%	On 2-in.	3.2%
2-1½-in.	30%	4- to 8-mesh	18%	2-1½-in.	16.1%
1½-1-in.	20%	8- to 14-mesh	20%	1½-1-in.	10.7%
1-¾-in.	19%	14- to 28-mesh	20%	1-¾-in.	10.2%
¾-½-in.	16%	28- to 48-mesh	23%	¾-½-in.	8.5%
½-¼-in.	8%	48- to 100-mesh	10%	½-¼-in.	8.0%
¼-in.	1%	100-mesh	1%	¼- to 8-mesh	8.9%
				8- to 14-mesh	9.3%
	100%		100%	14- to 28-mesh	9.2%
Fineness modulus = 7.70.		Fineness modulus = 3.34.		28- to 48-mesh	10.7%
				48- to 100-mesh	4.7%
				100-mesh	0.5%
					100.0%
				Fineness modulus = 5.67.	

ratio obtained in all cases excepting mix No. 6. However, the evidence again supports the contention that the sizes ¾-in.-4-mesh are essential to the properly graded combined aggregate, especially when the sand is deficient in coarser particles.

One other instance will be given to show our experience with the advantage of properly grading a sand and slag combination for better concrete strength. During the past year a great dock development has been under way near Toledo. Slag was chosen as the coarse aggregate for the 70,000-odd yards of concrete. The gradation of this slag, the selection of the sand and the proportions of each material were determined by the distribution curve of the combined aggregates. The screen analyses of the separate and combined aggregates appear in Table 7. (See Chart Fig. 8 for distribution curves of the single and the combined aggregates.)

The first 800 cylinders taken from the job during the fall of 1929 and early part of 1930 gave the following average compressive strengths, field curing, 6 and 27 days, respectively:

7 day	28 day
1850 lb. per sq. in.	3230 lb. per sq. in.

This is unquestionably high strength for a cement content of not more than five sacks per cubic yard of concrete. This large construction job gives sufficient evidence of the practicability of designing concrete by the

TABLE 6. EXPERIMENTS TO DETERMINE EFFECT OF OMITTING FINER FRACTIONS OF COARSE AGGREGATE

Orig. No.	F. M. Comb.	Mix by weight	2-1-in. No. 3	1-1½-in. No. 4	½-¼-in. No. 6	Rodded weight per cu. ft. Coarse	Rodded weight per cu. ft. Comb.	Gross water/cement	Sacks per cu. yd. concrete	Compressive strength 8 days	Compressive strength 28 days	Compressive strength / Cement factor 8 days	Compressive strength / Cement factor 28 days
1	5.01	1:3.11:2.51	100%	....	....	79 lb.	118 lb.	.973	5.45	1965 lb.	2630 lb.	360 lb.	482 lb.
1a	4.79	1:3.11:2.51	50%	50%	....	78 lb.	118 lb.	.965	5.47	2235 lb.	3133 lb.	407 lb.	573 lb.
5	4.77	1:2.95:2.75	50%	25%	25%	84 lb.	119 lb.	1.033	5.42	2146 lb.	3260 lb.	396 lb.	602 lb.
6	4.74	1:2.84:2.89	33%	34%	33%	86 lb.	118 lb.	.922	5.53	2553 lb.	3744 lb.	462 lb.	668 lb.
7	4.72	1:2.94:2.75	30%	50%	20%	86 lb.	115 lb.	.932	5.45	2243 lb.	3330 lb.	412 lb.	611 lb.
8	5.30	1:2.94:4.55	30%	50%	20%	86 lb.	110 lb.	1.334	4.42	1073 lb.	1885 lb.	246 lb.	427 lb.

outlined principles of combined aggregate analyses and gradation.

* * * * *

Effect of Gradation on Strength of Concrete

Of the several recent papers dealing with the effect of gradation of aggregate upon the strength of concrete, the report by W. F. Kellermann of the work by the Bureau of Public Roads (*Public Roads,* Vol. 10, 72-84, 1929), has been most challenging. There are some elements of surprise in the conclusions as well as in the methods of conducting and reporting the tests. Some of these must be taken up since the subject matter parallels that being presented in this paper.

It seems first of all that no particular attention had been given the type of gradations used. While the gradations do differ to some extent, none seems to be particularly good and no systematic variations were carried out to guide us in future thoughts about gradations. The screen analysis of each gradation is not given closely enough to guard against considerable ranges within each size limit, such as 1¼-in.-2-in. While this may have been controlled, no mention is made of it.

Regardless of how explicit or feeble is our faith in the utility of the fineness modulus, this conception has certainly made its contribution to the advance of the science of designing concrete mixes. Unfortunately the Bureau did not publish in the standard sieve series the analysis of the sand used in this investigation, especially since gradation of the aggregates was one of the factors studied. We all know that the importance of scientific data is not confined to the author's opinions, but is enhanced as others can use these facts. To be useful they must be in terms commonly employed by others. Being greatly interested in this report, we wished to know more about the sand used. Hence a sample of Maumee river sand was screened to give the analysis used in this investigation, was then screened with the standard sieve series and the fineness modulus determined. While this may not correspond exactly, it is at least interpretative of certain observed facts.

Bureau's Reported Grading

Retained on ¼-inch	1%
Retained on 10-mesh	12%
Retained on 20-mesh	25%
Retained on 30-mesh	42%
Retained on 40-mesh	72%
Retained on 50-mesh	93%
Retained on 100-mesh	100%

Observed Analysis by Standard Sieve Series

On 4-mesh	1%
On 4- to 8-mesh	8%
On 8- to 14-mesh	12%
On 14- to 28-mesh	16%
On 28- to 48-mesh	51%
On 48- to 100-mesh	12%
On 100-mesh	0%

Fineness modulus = 2.56

Thus we have a sand deficient in both coarse and fine material and overloaded with the 28- to 48-mesh size particles. These undesirable features probably account in a large measure for the generally low compressive and flexural strengths obtained in the investigation, even with fairly high cement contents.

Mineralogical Effects

The range of coarse aggregate chosen by the Bureau of Roads is wide and interesting. The mineralogical classification is helpful. It seems, therefore, that some such classification should have followed when the data were tabulated for the several types of aggregate used in the investigation. Since the author did not do this, we have classified in the chart Fig. 9 the aggregates according to chemical or mineralogical composition as nearly as could be done from the information given. This arrangement throws a little suspicion on Conclusion No. 5 of Kellermann's paper which reads:

"5. That there is a fairly definite relation between certain mineralogical characteristics of the coarse aggregate and the strength of concrete, calcereous aggregates in general giving consistently higher flexural and tensile strength than silicious aggregates."

Chart Fig. 9 shows that there is to be some increase in strength with increments of *calcareous* material when the data are arranged in a systematic order according to composition. However, the individual variations are great and make the means of less comparative value. Fortunately this is the case since otherwise it could work a hardship upon certain aggregates without any possibility of correcting that condition. Fancy an engineer telling a gravel producer that his product contained too much gneiss or schist or quartz and that he must put in more calcareous material if it is to be acceptable!

Clause No. 7 in the conclusions must not be overlooked since it is opposed to the thesis which our present paper presents. Quoting: "7. That within the limits of this study, variations in grading of coarse aggregate have no consistent effect upon the strength of concrete. (It is not to be inferred from this statement, however, that control of grading is not important. Variations in grading occurring during construction not only affect

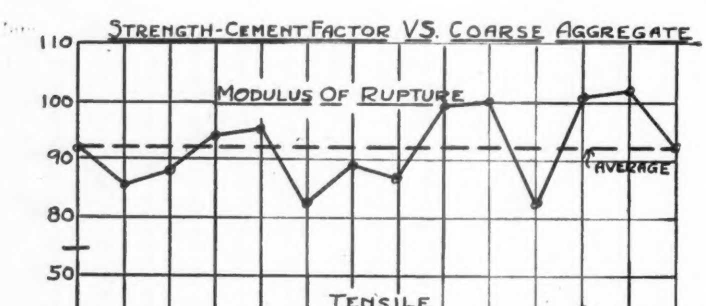


Fig. 9

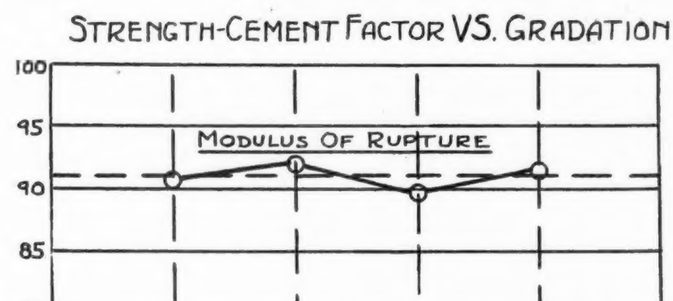


Fig. 10

yield when measurements are made by volume but also affect the workability and therefore the uniformity of concrete.)" Averaging all types of aggregate for each gradation, the several strength values are shown on the chart Fig. 10. It will be noted particularly for the compression values that a definite relation between gradation and strength *does* exist. Grading No. 2 is the best of the four. This grading gives the distribution curve most nearly coinciding with our proposed curve for proper gradation of combined aggregates.

It is interesting to note that we are told to guard against grading variations in aggregates as produced commercially, but no suggestion is made of their effect on the proper design of concrete. Even here, average differences of 5-10% between the compressive strengths of grading No. 2 and No. 4 have been overlooked in favor of no greater average differences between calcareous and silicious types of aggregates. It seems well worth while recognizing the differences in type which Kellermann has pointed out even though they are beyond hope of control or change. It is, however, more pertinent to know and use the grading factors which the data in that report sustain and which are well within our power to change.

Stone vs. Gravel

Just now a tremendous amount of energy is being expended in making comparisons between aggregates in commercial competition. This is a sign of the times. No doubt a great deal of this strife is directly beneficial since it helps each aggregate industry to trim its sails a bit closer. However, there isn't enough time left for the discovery of certain fundamentals common to all aggregates. The whole industry and all related industries suffer thereby.

As an example of this, though, let me refer again to the paper by Kellermann. When all the gravel and the stone concrete values shown in it are averaged, this tabulation results:

TABLE 8. GRAVEL VS. COARSE STONE AGGREGATE

	Water/ cement	Bags cement per cu. yd.	Modulus of rupture	Tensile strength	Compressive strength
All gravels	0.85	5.63	520 lb.	215 lb.	3020 lb.
All stones	0.93	5.90	545 lb.	235 lb.	3070 lb.

Certainly these differences are not great, being in each case less than 10%. However, Stanton Walker, director of the engineering and research division, National Sand and Gravel Association, was impelled by our present tendency to hurriedly come into print in defense of gravel. This he[8] did in excellent fashion, calling attention to the fact that equal cement contents were not used for both gravel and stone concrete. When these are reduced to *approximately* the same value he showed Kellermann's values to be changed to this degree:

TABLE 9. GRAVEL AND STONE CONCRETES COMPARED FOR EQUAL CEMENT RATIO

	Modulus of rupture	Tensile strength	Compressive strength
All gravels	535 lb.	210 lb.	3130 lb.
All stones	515 lb.	225 lb.	2830 lb.

Again we are left with no difference over 10%, although what difference there is favors the gravels. No doubt this doesn't exactly suit the stone adherents. Certainly slag was not done full justice in Kellermann's discussion and conclusions. Nevertheless, let us hope that the case of "Types of Aggregates versus Each Other" rests. Lest we be misunderstood, let us hasten to say that we feel Walker was perfectly justified in calling attention to the fact of unequal cement contents, which, when rectified, overcame the difference found and reported by the Bureau of Public Roads laboratory. The surprising thing is that these percentage differences which he pointed out are no greater than those due to gradation, which both Kellermann and he left unhonored and unsung.

In another splendid paper, presented before the Cleveland Engineering Society, Walker presented the results of a recent investigation. One conclusion on gradation is pertinent and is quoted: "Tests carried out in the National Sand and Gravel Association laboratories on gravels graded to cover the extreme range of common specification limits have shown comparatively minor differences in strength—less than 10%." Since Walker extended the courtesy of sending his data for our perusal, we feel sure you will be interested in knowing which of his gradations gave the best results. Chart Fig. 11 shows the distribution curves and Table 10 their strengths of concrete. Very evidently, the curves most closely fitting the type which we are advocating again show the best concrete strengths, namely, those with proper amounts of intermediate sizes of materials.

TABLE 10. DATA FOR DIFFERENT MIXTURES AND GRADINGS OF COARSE AGGREGATE

	1-2-3				1-2-4				Designed			
Sand	Coarse	Med.	Fine	Av.	Coarse	Med.	Fine	Av.	Coarse	Med.	Fine	Av.
					Water-Ratio							
					Compressive strength—lb. per sq. in.							
Coarse	3040	2840	2880	2920	2620	2225	2530	2460	2785	2710	2545	2680
Medium	3280	3065	3085	3145	2645	2385	2320	2450	3060	2930	2725	2905
Fine	2830	2870	2735	2810	2260	2395	1980	2210	2840	3205	2980	3010
					Flexural Strength—lb. per sq. in.							
Coarse	535	500	515	515	550	475	465	495	535	490	515	515
Medium	545	515	550	535	550	500	515	520	535	535	515	530
Fine	545	520	490	520	510	490	495	500	570	555	560	565

At the last annual convention of the National Crushed Stone Association, F. H. Jackson[9], in charge of the Bureau of Public Roads laboratory, presented an excellent paper propounding two ideas of interest. While these ideas affect state highway engineers primarily, all others interested in concrete construction can profit thereby. The first is that concrete pavements should be designed primarily on their flexural or transverse strength requirements. Secondly, that each state should make a careful study of the various aggregates which could be used for any certain road job and make actual determinations of the flexural strengths developed by various combinations of aggregates and varying proportions of cement before these materials are used in construction work.

Examination of Aggregates

These are among the most wholesome suggestions made in late years. However, even casual consideration will show that an immense amount of laboratory work is necessary preliminary to the opening of bids for any road job if these ideas are to be carried out, and if this needed information is not already available in the files of the highway laboratories. Hence these statements are made which, if accepted, will save needless labor:

(*a*) The strength of concrete *is* affected by the gradation of the aggregates combined in it.

(*b*) A sieve and screen analysis made on the separate aggregates will indicate which combinations are worthy of further consideration and trial in concrete. Combinations giving bad distribution curves beyond power of correction, can be eliminated from the comparison before they are run since they will produce concrete of lower strength.

(*c*) Proper aggregate grading specifications based on the conception of *combined* aggregates can control very largely the quality of concrete by preventing the occurrence of poor combinations of aggregates.

(*d*) It may be advisable to consider and specify two gradings of sand, one for gravel and another for stone and slag, to account for natural differences or to overcome differences which have been induced by having unlike grading specifications for each type of coarse aggregate. In general the broken aggregates should have the coarser sand as well as more of it.

[8] *National Sand and Gravel Bulletin*, Dec., 1929, pages 5-13.

[9] *"Discussion of Suggested Specifications for 'Designed Mix' Concrete for Pavements,"* Jan., 1930.

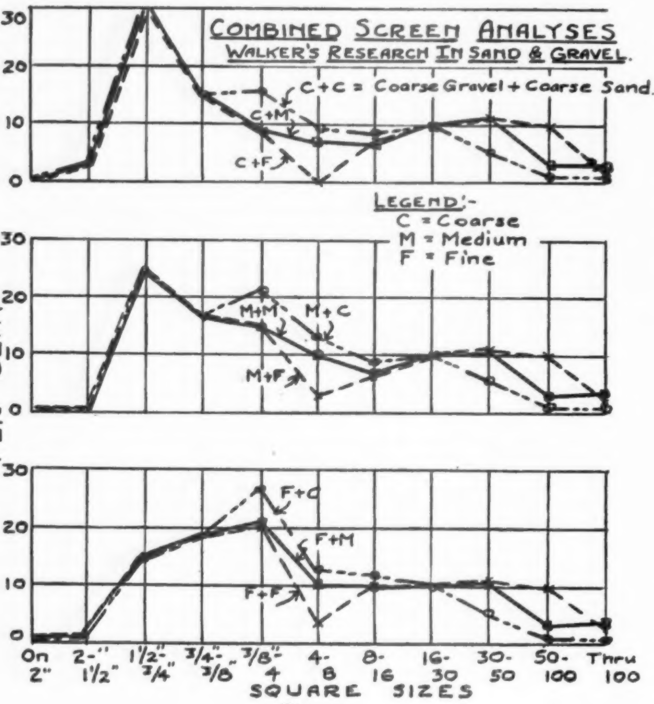


Fig. 11

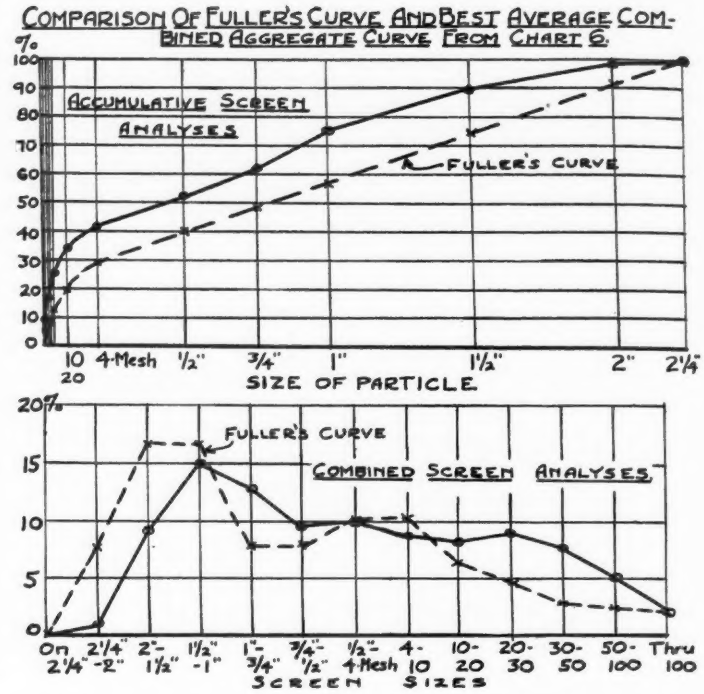


Fig. 12

A. T. Goldbeck[10] has recently thrown considerable light on the subject of dust in broken stone aggregate. He found in general very little decrease in strength and wear resistance in concrete one year old made of stone coated with amounts of dust exceeding any usual occurrences in commercial stone. This may help some engineers to fear less the addition of the smaller sizes to a broken stone aggregate. Furthermore, the practice of washing stone at the crushing plants is so general that unwashed stone is fast becoming the exception. Slag, being practically free from adhering crusher dust, does not require this cleaning process. The kind of washing performed at modern gravel plants places that aggregate beyond question as far as adhering dirt is concerned. Thus, the major modern aggregates are all free of the objection of uncleanliness which has often caused specification writers to minimize the quantity of smaller coarse aggregate permitted.

Producers of gravel normally have an abundance of the smaller sizes (¾-in.-¼-in.) of material. The progressive producers of crushed slag and stone likewise have no desire to rob concrete aggregate of this size of material provided engineers realize its importance and request its presence in proper amounts.

The most apparent objection to the presence of enough of this intermediate size, namely, segregation, can be overcome by two methods: (a) shipping the coarse aggregate in two separate sizes and combining them on the job; (b) permitting the sand to carry more material up to ⅜-in. or ½-in., since less segregation occurs in the sand than in the coarse aggregate. We feel therefore that no good reason remains for avoiding the proper amount of the intermediate sizes in concrete aggregate.

Fuller and Thompson's Work

No discussion of aggregates and gradation relationships can be complete without some reference to the fundamental work of Fuller and Thompson[11] in this field. The general criticism against their early work has been that harshness was a characteristic of their concrete mixes. Perhaps we have heard so much of harshness and workability in this day that the more significant phases of their work have been overlooked. One fact must be remembered—namely, that the reference of Fuller and Thompson to density as an index to concrete quality is *not on the basis of the aggregates alone or even combined* but is based on densities obtained with cement, aggregates, and water combined. This throws an entirely different light on the matter of densities in concrete constituents.

A second noteworthy fact is that the usual type of Fuller's curve portrays the *combined aggregate*. Thus far most of our specifications have lost this important perspective and have been directed largely at each separate aggregate with no thought of combinations which might result.

A third pertinent point is that the Fuller distribution curves are straight lines over a range of sizes from the upper limit of the coarse aggregate to one-tenth of that value. Therefore, Fuller's curve calls for more of the marginal material (¾-in.-10-mesh) than is commonly permitted today. The data we have presented earlier in this paper support Fuller's curves in this zone with remarkable agreement.

Any accumulative curve such as Fuller's type does not give sufficient space for clarity's sake to the finer sizes of aggregate. Perhaps for that reason engineers have not caught the vision of the importance of the sand fraction of concrete aggregate. Certainly durability, imperviousness, and other properties of concrete aside from its strength values are in the main dependent upon quality of the mortar. Just as certainly the quality of the mortar depends very largely upon the gradation of the sand. This matter justifies a great deal of research and attention. The scope of this paper does not permit more than stating that the type of distribution curve presented and discussed herein *does* show up the virtues and the vices of sand gradations which the accumulative curves cannot do. In the chart Fig. 12 are shown the two types of curve on the same materials. It is obviously easier to detect differences and irregularities in the curves of the lower chart than in the upper. Also the fine aggregate fraction is portrayed as clearly as the coarse aggregate in the lower chart.

Proper Aggregate Size Distributions

It will be of interest to note very briefly what the various state highway departments have done toward proper aggregate size distributions. We have taken the following facts from the "Charted Summary of Concrete Road Specifications" prepared by the Portland Cement Association, with corrections for 1929. Regarding the upper limits of sands, 24 states permit nothing above ¼-in. or 4-mesh, 17 states permit 5%, 3 states allow 10%, and 4 states allow 15%, the average being 3.6%. Regarding the lower limit of coarse aggregates, one state permits nothing below ¼-in. or 4-mesh, 30 states permit 5%, 10 states permit 10%, 3 states allow 15% and 5 have no specifications at this size. The average permitted smaller than ¼-in.

[10] *Crushed Stone Journal*, Feb., 1930, pages 7-8.

[11] *Trans. Amer. Soc. Civil Engineers*, Vol. 59, 66-172 (1907).

or 4-mesh is approximately 7%. Thus we see a deficiency in the intermediate zone is *actually demanded* by specification in most cases. The data presented in this paper indicate that this is *not* a desirable condition as far as the quality of concrete is concerned. Fuller's distributions are likewise opposed to this practice. It is to be hoped that these and other investigations will give us a clearer and more correct conception of the proper distribution of sizes in concrete aggregate than the one commonly held at present.

Conclusions

In concluding this paper, we wish to restate briefly the ideas presented:

(1) Low voidage of separate or combined aggregate alone is not necessarily a desirable property.

(2) Low voidage produced in the separate or combined aggregates at the expense of proper distribution of sizes is generally uneconomic and scientifically unwise and may lead into absurd combinations if carried too far.

(3) "Gap gradings" or distributions of sizes with definite deficiencies of certain sizes are to be avoided if possible, whether these occur in the coarse or in the fine fraction or, as is often the case, in the zone between the two fractions.

(4) A graphic method of analyzing the distribution of sizes in aggregates is given to facilitate the appreciation of good and weak points in aggregate combinations and to indicate adjustments if necessary.

(5) The conception of *one combined aggregate* as the mass to be cemented together instead of mortar and coarse aggregate, etc., helps in the appreciation of some factors often overlooked.

(6) Perfectly satisfactory coarse or fine aggregate may make poor concrete if each is paired with a poor mate.

(7) Present tendencies in the dual conception of aggregates are more apt to a deficiency in the intermediate zone of sizes than to an excess. This condition works a relatively greater hardship on slag and stone than on gravel because of the normally lower voids in the latter.

(8) Because of this natural condition, more mortar is required to fill these voids and provide lubrication of the mass. To secure the same strength, therefore, it is advisable to increase the coarseness of the sand or to permit a greater quantity of coarse aggregate below ¾-in.

(9) The importance of ¾-in. to 10-mesh sieve material is shown in all types of aggregates. The most efficient combined aggregates in terms of strength per cement content were found to contain from 21-29% of this intermediate fraction.

(10) Differences of about 10% in the strength of concrete can result more easily from changes in the gradation of the same type of aggregate than from a change from one type of aggregate to another.

(11) Until our present conception of "fine aggregate" as ¼-in.-0 changes we must supply the intermediate material largely with fine material in the coarse aggregate.

(12) Not only the proper quantities but also the proper distributions of these sizes are reflected in resulting concrete values.

(13) Types of distribution curves of combined aggregates have been shown and discussed. Supporting evidence has been given for their correctness with data from both construction on the large scale and from carefully controlled laboratory investigations.

(14) The hope is expressed that we become more conscious as to aggregate factors in general and more conscientious as to discriminating between types of aggregates.

McGrath to Open New Pit

THE McGrath Sand and Gravel Co., Lincoln, Ill., of which Clyde Woodrum is the local manager at Pekin, Ill., has made arrangements to establish a gravel pit on the Charlie Boyle farm west of Mackinaw.

Tests have been made on the farm and the gravel is found to be of high quality with the smallest amount of sand in it that has been found anywhere near in any gravel bed. The pit which has supplied gravel for some years is gradually running out and it was necessary that new grounds be located. —*Pekin* (Ill.) *Times.*

New Cement Plant Projected in South Carolina

THREE DISTINCT GROUPS of financiers are considering the advantages of establishing a modern cement manufacturing plant in South Carolina with the prospect of selling the state highway department cement for its four-year road building program as its main impetus.

Representatives of at least one of these groups conferred with C. E. Jones, chairman of the state highway commission, although the state department will have nothing to do with construction or operation of any cement plant except as a purchaser.

"We would like to see a cement plant in South Carolina," Mr. Jones remarked, "but the highway department cannot become involved in it. It would not be a wise step for us to compete with private manufacturers but we can place our orders with a South Carolina concern if it can offer equal or better prices on cement."

Freight charges are highly instrumental in price regulation on cement. A mill within the state, such as in Orangeburg county, where, Mr. Jones is led to believe, is found suitable materials for making cement, would reduce cement charges materially and enable the state to effect a saving on concrete road work.

The cement dispute between domestic manufacturers and the state highway department is believed to have been the incentive for the proposal to establish a plant in South Carolina. The department charges the manufacturers with combining to maintain their "price structure" and to keep the price of cement on a high level—a level the department says is unjust and without justification based on market conditions.

All bids from domestic plants were rejected when the department opened proposals May 15 for 1,000,000 bbl. of cement for the first road work. The department finally approved a contract with the Carolina Portland Cement Co. of Charleston for the lot and inserted an agreement that the department could cancel the contract should the pending tariff become effective before the cement reaches this country. The Charleston concern proposes to import the cement through Charleston.—*Columbia* (S. C.) *State.*

More About South Carolina's Proposed Cement Plant

ASSURANCE can be given financiers who propose to build a cement manufacturing plant in South Carolina that the state highway department will purchase 5,000,000 bbl. of cement from the new plant provided that the plant equals competitive prices, C. E. Jones, chairman of the highway commission, declares.

Ten months will be required to construct the cement plant and more than two years for the power development. Power, however, will be available from an allied development which will have a surplus of power due to deflation of manufacturing interests in North Carolina.

Governor Richards was informed of the situation by Chairman Jones, who announced that the state highway department could assure the proposed plant a market for its cement.

The state will save, he estimates, more than a million dollars, should a plant be constructed in central South Carolina; hundreds of men would be given employment; cotton mills of the state could furnish the cement bags, and the state would have a permanent industry.

Backing of the highway department is not necessary for a cement plant to be constructed within the state. The department iself will not own or become involved, except as a large customer, in the plant, it is said.

Besides the power company interests, two other groups, Mr. Jones says, are considering the possibilities of the plant. A coalition of Charleston and Greenville interests and a group of New York bankers and cement men are also said to be scrutinizing the prospects.

Orangeburg county land, Mr. Jones has been informed, contains minerals needed for cement manufacture. Samples of the soil are being analyzed.

Governor Richards assured Mr. Jones, after being told of the possibilities, that he would co-operate in every way possible. His interest in the situation, he said, was paramount.—*Augusta* (Ga.) *Chronicle.*

Use of Lime in Glue, Size and Gelatin Manufacture*

By Alfred B. Searle
Consulting Adviser to the Lime, Cement and Clay Products Industries

GLUE, GELATIN, AND SIZE are different forms of the same material which is obtained by boiling animal flesh, skin or bones. To make clear properly the function of lime in the glue and gelatin industry, it is necessary to point out briefly the several steps in glue and gelatin manufacture. Several types of raw stock are used, which include hide-pieces and trimmings from the tanner or the packer; fleshings, which consist of the under-layer of the hides and are made up of loosely packed fibres of skin substance, fat cells, and thin muscles attached to the skin; sinews or tendons and connective tissue; ossein, which is the organic portion of bones left behind when the mineral matter is dissolved out with acids, and bones. All of these, with the exception of untreated bones, are conveniently grouped together as "hide-stock." Since bones receive a different lime treatment, they may be omitted from this discussion.

Preparing the Hide-Stock

The washed and shredded "hide-stock" is allowed to stand in vats with milk of lime for about two weeks. The stock is forked out and fresh milk of lime is added. After two or three such treatments the stock will have attained a plump, uniformly swollen condition, and it is then removed and washed, first with water and subsequently with a dilute acid solution, to neutralize the excess of lime. The stock is placed in a large open tank, with water and steam admitted until the mixture has attained a temperature of 80 deg. C., or higher. This operation, known as the boiling process, extracts the gelatin. The liquor is run off after a few hours, and the boiling repeated a number of times with fresh lots of water. The liquors may then be filtered or clarified, and being too thin to gel well, are concentrated *in vacuo* and allowed to form a jelly, after which they are dried and ground as desired.

The lime is used to greatly increase the volume of the stock and to loosen the hair. It also effects important chemical changes. If raw hide were heated with water, solution would be effected very slowly, unless a temperature above 100 deg. C. (under pressure) were used. But gelatin, the constituent of glue which gives it the power to form a jelly and upon which adhesiveness seems to depend, is a heat-sensitive substance, and when exposed to high temperatures rapidly undergoes a decomposition, breaking up into constituents which have very little or no value as jelly producers or adhesives. As a result of the lime treatment, however, the hide pieces are enabled to pass into solution by only a moderate heat treatment with water, and the valuable properties of the gelatin are preserved.

Loosening Action of Lime

The precise action of the lime in bringing about this result is not yet clear, but it seems that the lime solution induces a loosening and separation of the fibres in the hide, and the distension produced by it offers a greater surface to exposure and, consequently, permits a greater rapidity of solution.

This plumping action appears to be due to a particular concentration of hydroxyl ions or alkali, and the alkalinity of a saturated solution of lime is very close to that at which maximum swelling occurs. Clear limewater very rapidly becomes less alkaline, and is soon almost neutral, but by using milk of lime this difficulty is overcome, as the "milk" is merely a saturated solution plus an excess of the undissolved lime. As rapidly as the hydroxyl ions are removed by the hide, just so rapidly will the undissolved lime pass into solution. By this means the alkalinity of the mixture is automatically held constant. This property of a nearly foolproof and automatically controlled alkalinity makes lime better than most other reagents for this service.

Glue and Gelatin Manufacture

Besides collagen, which is converted into gelatin by heating in water, glue-stock contains several other proteins that have no value whatsoever in glue. If these substances were allowed to be cooked with the stock, the product would be weakened, and would also give a turbid, muddy, or opaque glue. These proteins, especially albumen and mucin, are soluble in alkaline solutions, and so are dissolved out of the stock by the lime, which is particularly suitable for the purpose, as solutions of stronger alkalinity would dissolve increasing amounts of the collagen, and solutions of weaker alkalinity would not be effective. Some of the fat of the stock is also acted upon by the lime, forming insoluble lime soaps that should be removed in the washing process if a clear product is desired.

The greater part of the fat is liberated in the "boiling" process, and can be removed by skimming, but some is converted into insoluble lime soaps, and can be recovered by washing and subsequent treatment.

In the manufacture of glue and gelatin from bones, the latter are crushed and then degreased in a closed steel tank with a volatile solvent (benzine or carbon tetrachloride), which is afterwards distilled off from the grease and recovered. The bones are then leached in dilute (about 8%) hydrochloric acid, whereby the mineral constituents are dissolved, leaving a soft, cartilaginous substance (collagen), which preserves the original shape of the fragment of bone.

The solution contains acid phosphate of lime, which is afterwards precipitated by the careful addition of milk of lime in very slight excess. The "precipitated bone phosphate" is largely used in the manufacture of "bone china," and the "acid phosphate" is used in baking powders. In order to avoid an excess of lime, which would reproduce tricalcium phosphate, a filtered sample of the liquor is, from time to time, tested with a solution of ammonium molybdate, which will give a yellow precipitate if any phosphoric salt remains in solution, and the addition of lime stopped as soon as the failure of the ammonium phosphomolybdate precipitate to form, indicates that no more phosphoric acid or acid phosphate is in solution. If an excess of lime be accidentally added, the error can be retrieved by the addition of a suitable quantity of the acid liquor. The precipitate is pumped or forced by compressed air into a filter press and washed free from soluble salts.

The soft collagen is washed free from acid (using lime water to neutralize if necessary), and made directly into glue, but some of it usually is dried at a low temperature, yielding commercial ossein.

Better Quality Products

A product of better quality than usual is obtained by adding the calculated quantity of milk of lime, stirring thoroughly for several minutes and then allowing the precipitate to settle. The liquor is then run into another neutralizing vat and the neutralization completed therein. The two precipitates may either be mixed or kept separate. The first will be mainly the acid phosphate.

*From a series of articles on "Limestone and Its Products," in *The Stone Trades Journal*, London, England.

The second precipitate will be richer in tricalcic phosphate.

The milk of lime should have a specific gravity of 1.116, and should be made by adding the calculated quantities of slaked or hydrated lime and water to a mixing vat, or by slaking quicklime in water, adding a little more water, passing the liquid through a sieve with at least 60 holes per linear inch, and then diluting with water, if necessary, until the desired specific gravity is obtained. It is desirable to use a duplicate plant comprising two neutralizing vats and two lime vats, one of each pair being used for the neutralization while the others are employed in preparing the milk of lime and the acid liquor.

Fresh Bone is sometimes boiled without a preliminary washing; but if washed and degreased (by the so-called benzine process), it yields a much clearer glue. Bones may be made into glue by the "sulphurous acid process" patented by Grillo and Schroeder, according to which bones are disintegrated by moist sulphurous acid gas or liquid sulphur dioxide. Bones thus treated readily dissolve in hot water; any acidity is neutralized with milk of lime, and the resulting "mud" after the calcium sulphite is oxidized by exposure to the air or by oxidizing agents, forms a valuable fertilizer.

Prepared Horn Pith is an ossein stock made from the interior supporting bony core of horns. As it is the only part of the osseous structure that does not come in contact with flesh, horn-pith yields a singularly pure and high-class gelatine, and its porous structure renders easy its treatment and subsequent extraction.

Fish Stock, i. e., the heads, bones and skins of fish similarly treated yield liquid glues. The swim-bladders of certain species of fish constitute what is known a *isinglass*.

The later stages in the manufacture of glue and gelatin do not use lime to any appreciable extent, and so need not be described.

It is important to use care in the selection of the lime for hide swelling, for it has been found that dolomitic limes which contain large amounts of magnesia are decidedly inferior to the high calcium limes. For some reason that is not entirely clear, the magnesia tends to offset the normal swelling induced by the lime. In practice it is usually most satisfactory to procure a high-grade quicklime and slake it at the works just prior to use, or to use hydrated lime.

The iron oxide content of the lime should be low, as otherwise the color imparted by it to the finished glue or gelatin may be objectionable, and bleaching may then be necessary. The fineness and freedom from impurities of hydrated lime, and the ease with which it can be used, more than offset its greater cost, and give it special advantages in the manufacture of glue, size and gelatin.

Advertising Oyster Shell Lime

THE HADEN LIME CO. of Houston, Tex., which is the only producer of oyster shell lime using the rotary kiln process, has issued an exceedingly attractive booklet describing the properties of oyster shell lime and how it is prepared.

The booklet is well illustrated and done in four colors, making a striking bit of

Reproduction of a page from the Haden booklet describing lime produced from oyster shells

advertising literature. The care and artistry displayed by Sidney P. Armsby, service director of the Haden Lime Co., in compiling this booklet is very commendable.

Appended to the booklet are valuable references and conversion tables which are intended to serve the metallurgists, chemists and others who use lime or lime compounds.

Cincinnati Contractors Organize Own Gravel Company

A GROUP of Cincinnati, Ohio, public works contractors recently received incorporation papers from the secretary of state under the company name of the Contractors' Sand, Gravel and Supply Co. The home office of the company is located at 212 Hazen building, Cincinnati. The company has a paid-up capitalization of $100,000.

The company will operate sand and gravel pits at Newtown and also will handle contractors' supplies. The incorporators are: Pinckney Brewer, president of Brewer and Brewer Sons; Joseph A. Byrnes, president of the Byrnes-Conway Co., Clarence Murdock of the Murdock Construction Co.; Philip Freshwater, president, E. A. Freshwater and Sons; Michael Hannon, president, the Hanon Hughes Construction Co., and Alfred F. Deckebach, former city auditor.

Mr. Brewer will be president of the new corporation, Mr. Byrnes, vice president; Mr. Murdock, secretary and treasurer, and Mr. Deckebach will be general agent.—*Cincinnati* (Ohio) *Inquirer*.

Vermont Slate Producer in Receivership

ON PETITION of the People's National Bank of Salem, N. Y., Judge Harland B. Howe of the United States District Court on June 5 appointed Henry A. Spallholz, president of the bank and also president of the First National Bank of Poultney, Vt. as receiver for the Consolidated Slate Corp. of Poultney.

In the bill of complaint filed by the bank, its officers allege that the slate corporation is indebted to the bank to the extent of $11,975.89 and that large sums are due others.

The receiver will take charge of the business and will endeavor to conserve the assets of the corporation and pay the creditors.

The petition alleges that the slate corporation has only a small amount in liquid assets but that its property will amount to a large sum, the amount being unknown. Besides the $11,975.89 alleged due the bank, the bill of complaint alleges that the corporation owes $41,730 in short term notes, and $42,876,53 in open accounts, most of which are said to be past due.

The total indebtedness of the concern was said to be over $96,000.

The petition alleges that the Unfading Slate Co., a Vermont corporation of Fair Haven, has attached the property of the Consolidated Slate Corp. in order to secure the collection of an open account amounting to $1141.85, and that other creditors are threatening to place attachments on the corporation's property. The plaintiff further alleges that the defendant has and threatens to continue the payment of dividends at the rate of 8% per annum to holders of $250,000 par value in preferred stock of the corporation and thereby has diverted and threatens to divert the assets of the corporation from payment of the concern's debts to which equity, the plaintiff avers, they should be devoted.

The plaintiff also stated that the corporation has about $150,000 in unfilled orders which, if the concern were properly managed, could be filled to a profit to the business.

The receivership of the Consolidated Slate Corp. follows close upon the heels of the closing of the First National Bank of Poultney. This bank is now in the hands of federal examiners but, according to announcements, the institution is expected to reopen soon.—*Burlington* (Vt.) *Herald*.

Prospecting for Mica in New Hampshire

Also a Few Facts Relative to the Quality of New Hampshire Mica

By H. N. Kirk
Keene, N. H.

THIS ARTICLE may hold no secrets for old timers in this line of prospecting for it is written more with the idea of being of aid to the beginner and to give pointers to country land owners on how to look for mica and also feldspar.

Locality in Which to Prospect

1. Always pick tracts of land that are near a good road or at least will not call for a large amount of road-building to reach main highway.

2. Hilly land seems to expose the pegmatite dikes to view better than low land.

Feldspar is found in pegmatite dikes; these dikes are irregular in form and vary in width from a few feet to forty or more. Their length may be from 50 to 300 ft. more or less. Pegmatite dikes are white in color and composed mainly of feldspar and quartz although beryl crystals, mica and other rare minerals may be found intermingled with the feldspar and quartz.

The best tools for prospecting are a bog hoe, common hoe and broom. These tools are used in merely locating a few bounds of the pegmatic dike, especially the two walls, the foot wall and hanging wall.

Pegmatite Dikes

Pegmatite dikes have a foot wall and a hanging wall as a rule. If both walls seem perpendicular they cannot be defined unless the angle of the dike changes with depth. The walls of a pegmatite dike here in New Hampshire are called slate, but this slate is not like the slate used for blackboards in schools, roofing slate, etc., but may be a coarse or fine grained rock of dark color composed of quartz, hornblende and tourmaline, mainly. It splits easily in one direction into flat slabs and drills very easily. It is important for one to get familiar with this slate as it is possible to find a vein of mica near the edge where the slate forms a union with the white pegmatite dike. This vein may be either on the foot wall or hanging wall or in some cases on both walls.

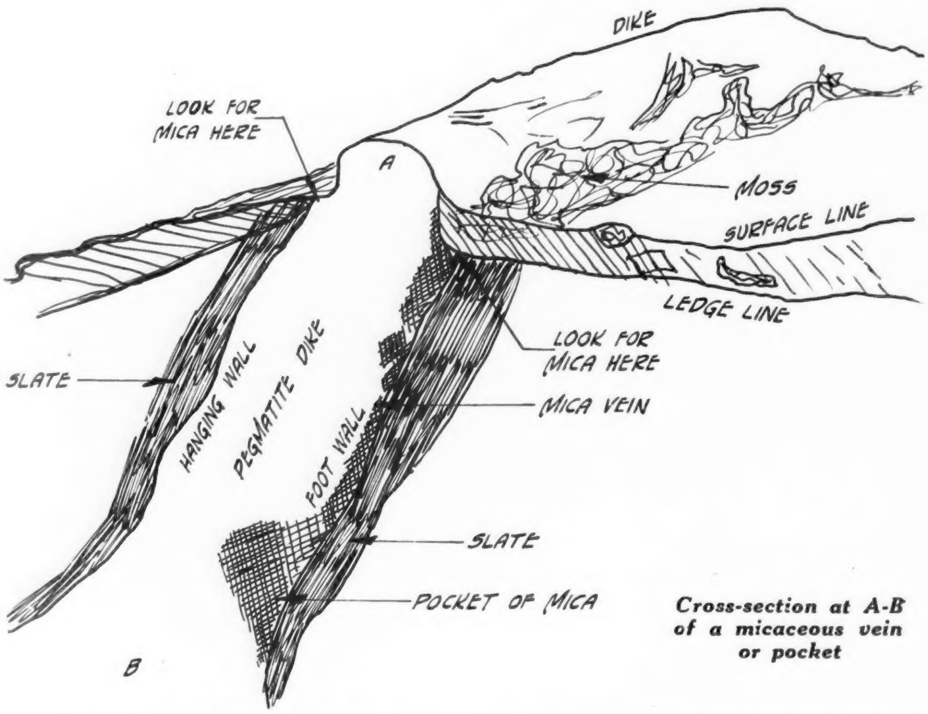
After locating a pegmatite dike, if it is free from iron rust and objectionable minerals such as tourmaline, fine grained mica and biotite mica (black mica) and shows feldspar in fair amounts on surface this dike may be a possible producer of feldspar.

The next step to be taken is to locate the two walls. As a rule the edges of the dike will be covered with moss, fern and brush and even trees. If the right rock seems to run under moss use the bog hoe to clear away a trench about 3 ft. wide at right angles to the general course of dike, and keep on in this course until you find the slate, if practicable. By that I mean if the overburden is not greater than what you can handle with a shovel.

Many a mica mine in New Hampshire has been located by removing a clod of moss and finding a mica showing existing there. As you dig away the moss and rich, black, leaf mold, take notice to see if any amount of mica shows in the dirt. If small pieces of mica are plentiful it would be well to dig to the edge of the slate and at that point of union between the pegmatite and slate look for your mica vein or pocket, brushing the ledge off clean with an old broom. This is important as it is often the case that books of mica will be standing on edge and will present a highly polished, dark appearance, very compact. This polished surface was caused by the glaciers ages ago.

To one not used to mica these books look like dark colored crystals other than mica imbedded in the white rock, but a few blows of the bog hoe will reveal its true identity as the flakes of mica fly on striking the books.

Mosses seem to thrive on weathered mica and feldspar so it is the rule rather than the exception that mica veins and pockets near the slate walls will be moss covered. Mica veins can be worked even if they are two miles or more from a highway if the mica is of good quality and a good road exists or can be built passable for teams, but to work a property for feldspar it must be more favorably located so as to be able to have a truck road to the mine. Often this road will cost from $500 to $3000 before a pound of spar is trucked. After trucking starts it is one continual struggle to keep the road in shape and a constant bill of expense.



Cross-section at A-B of a micaceous vein or pocket

It is the rule to mine at least three or four carloads of feldspar or at least have that amount in sight before much capital is laid out on a road to the main highway as oftentimes the feldspar does not hold out or keep up in quality to your expectations.

Mica

Ruby mica is the prevailing type in New Hampshire and is hard and has an electrical resistance that surpasses all other mica, India and Madagascar included. This fact makes it the most desirable for high quality electrical condensers for wireless equipment. Any electrical test as to the quality of mica should, out of fairness to all kinds, be made on well seasoned mica free from all moisture. It is important that all specimens tested should be dried thoroughly. A high grade mica containing moisture would break down under a smaller load than a poor grade well dried out.

If you have any doubt about moisture

getting between films of mica in a book of mica just take a handful of soot from a chimney and soak it in a pail of water and let a book of mica soak in this creosote water for a few days. Take out the book and let the surface dry off, then rift and you will have hard work to find a single sheet, no matter how thin you rift it, that does not show the coloring of the creosote water.

Seasoning Improves Quality

Mica that has been rejected for films has been known to pass tests at a later date after being well seasoned in a dry place. It is the popular belief that India mica will stand a higher electrical test than others. One reason that India mica has stood up so well in tests is because it is well seasoned and seldom freshly mined and has aged before it reaches this country. As a rule New Hampshire plate mica is sold at once and has not been seasoned as long as the India mica, so is more apt to be tested with a moisture content. This, of course, brings negative results as to its quality.

I have recently had it called to my attention by two large mica dealers, one in Boston and one in New Dorp, Staten Island, that New Hampshire mica was superior to all others in electrical tests. German interests are buying and leasing mines in New Hampshire and do not hesitate to state that New Hampshire ruby mica has stood the highest electrical tests of all mica they had tested. This being the case and I believe anyone will concede that German opinion on any electrical or mechanical tests is considered one of the best, one can but expect a great revival in the mining in New Hampshire.

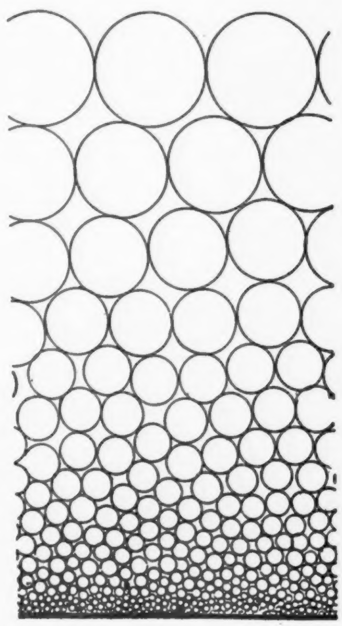
Climate, snow and ice, high cost labor ($4.00 to $5.50 per day) make the cost of New Hampshire plate mica higher than India under present tariff schedules so no large amount of plate is available and up to date new firms are willing to pay this extra cost.

It is at least gratifying to know that outside people (German interests) are willing to mine New Hampshire ruby mica in preference to mica from other sources.

Reverse Classification

THE POSSIBILITIES of reverse classification are discussed by Frederick C. Dyer in an article of a recent issue of *Engineering and Mining Journal.* Mr. Dyer teaches mining engineering in the University of Toronto, Canada, and explains the theory of reverse classification in a scientific and mathematical way.

Stated in its simplest terms, however, reverse classification is something that every-



Theoretical final arrangement

one has noticed who has shaken a pan filled with sand. The coarse grains come to the top and the small grains go to the bottom. If there is water in the pan the separation is somewhat easier to make because water reduces the friction.

In one of the illustrations in the article (which is reproduced here), it is shown that a large particle tends to roll over a small particle as a wheel tends to roll over a stone in the road. In more exact language, the horizontal energy is converted to a vertical component which raises it. If it strikes a small particle below, this component will be downward. But:

"Because of the progressive looseness of the bed of particles toward the top, the downward components of the upper small particles will be less than the upward components of the lower particles, the resultant of them all being a tendency to force the larger particle upward and the smaller particle downward.

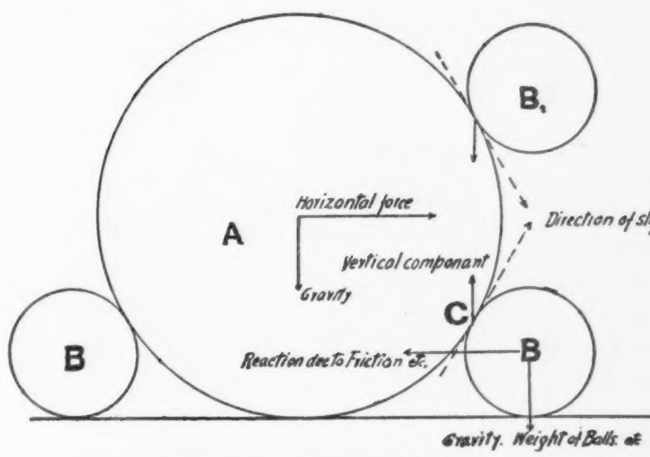
"The final arrangement will be a graded arrangement of particles from the largest at the top to the smallest at the bottom."

The author of the paper does not show any method of applying reverse classification in a practical way. He notes in this connection that while the top will be coarse and the bottom fine, there will be a layer of "middlings" between the two. This, he says, will be made up of particles of sizes that may be easily separated by water classification, either free settling or hindered settling. Consequently a combination of reverse classification with the ordinary types would be ideal in his opinion. The paper sums up reverse classification as follows:

1. With a sufficient degree of horizontal agitation a layer of particles of varied sizes and the same specific gravity will arrange itself with the larger particles above and the smaller below.
2. Considering any one material, the particles of greatest inertia will tend to go to the place of least motion.
3. If there are particles of varied sizes and differing specific gravities, the one of greater specific gravity will be graded in size in the bottom layer and the one of lighter specific gravity will be graded in size in the upper layer.
4. The larger particles of the material of greater specific gravity will associate with the smaller particles of the material of less specific gravity.

Considering how common the phenomena of reverse classifications are, it is surprising that no one has called attention to its possibilities before. In panning stream gravel for gold the first step is always to shake the mass violently in the gold pan to bring all the large stones to the top so that they can be swept off with the hand. Then the process is repeated until the particles are fine enough so that the heavy can be separated from the light in the usual way.

The principle might be applied mechanically to separate gravel from sand. It would also seem to have possibilities as a cleaning method. Trash such as sticks and leaves readily come to the top in a sand mixture when it is shaken horizontally with water.



The effect of horizontal agitation

Dimension Stone in the Granite Industry

OLIVER BOWLES, supervising engineer of the building materials section of the United States Bureau of Mines, has prepared a circular, No. 6268, covering the granite industry from the angle of its use in dimensional stone work. The paper deals with the occurrence and character of granite, types of products, uses and desirable qualities in a granite deposit. Economic factors, quarry conditions and methods, as well as finishing practices, are discussed at considerable length, which should be of interest to the industry.

Changes and Improvements at a Recently Built Crushing Plant

Oriskany Falls Plant of the Eastern Rock Products, Inc., Uses Special Wide-Bodied Dump Trucks for Quarry Haulage, Vibrating Screens, No Elevators, No Storage Bins, Stone Washed Before Shipping

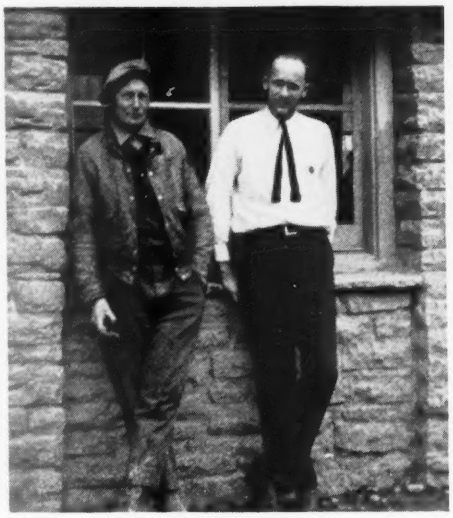
WHILE not a new plant nor a particularly large one as compared with some, the Oriskany Falls plant of the Eastern Rock Products, Inc., some 18 miles southwest of Utica, N. Y., on the road to Binghamton, combines a number of interesting and unusual features.

Perhaps the most striking feature at first sight is the way in which the slope of the ground below the main part of the plant has been used to gain a considerable storage of the various sizes of crushed stone. Instead of the usual loading bins below the screens, with their rather limited capacity, the screening and conveying is done on a framework above and along the edge of the slope in such a way that the sized stone falls directly into piles, with separating partitions between, and is reclaimed from them by means of a tunnel and belt conveyors which carry the product out to two loading bins.

In this way a total storage capacity of about 25,000 tons is obtained, and the loading out is entirely independent of the operation of the rest of the plant, permitting also of shipments in excess of the daily crushing and screening capacity of the plant. Washing previous to loading is done at one of the loading bins on those sizes from ¼ in. up to 2¼ in.

Another feature of interest is the use of vibrating screens for all sizing, and the use of belt conveyors instead of bucket elevators.

The plant was built about five years ago by the Peerless Quarries, Inc., which later was merged into the Eastern Rock Products, Inc.; the original plant was described in the August 21, 1926, issue of ROCK PRODUCTS. Some of the original details have been changed, but the general scheme remains the same. During the past winter a vibrating screen was substituted for the revolving screen previously used for scalping at the recrushing point, and at the same time the secondary crushers were relocated to do away with the one bucket elevator which had previously been used at this point.



Left to right, Earl Elmer, superintendent of the Oriskany Falls plant, and Harry Norton, clerk

As now arranged, with belt conveyors throughout and vibrating screens for all sizing, the plant operates most effectively and economically. All machinery is driven by individual electric motors operating on purchased electric power which is transformed down at the plant to 3-phase, 60-cycle, 440 volts. Falk speed reducers and Texrope drives are used throughout on the various unit drives.

Quarrying

The stone deposit is a fairly well stratified hard, blue limestone of the Trenton formation, covered with an average of about 8 ft. of overburden, which is removed as necessary by the quarry shovel and trucks. This stripping is not at present necessary since the quarrying is now being carried on below the previous operations. About three years ago, after quarrying off the top 36 ft. of that part of the deposit adjacent to the plant, operations were started on a lower level and a 66-ft. ledge is now being worked, which represents the depth from the previous quarry floor down to the present floor. On one side of the quarry the face is 102 ft. high (or up to the top of the previous quarrying operations).

Of interest in passing is the fact that the quarrying, crushing and screening operations are separated by two highways rather close together and on two levels, which introduced some problems in the connecting together of the different units. The main highway passing between the recrushing building and the screening operations is practically on the same level as the present quarry floor and the recrushing plant, while

Two views of the storage piles over the reclaiming belt conveyor showing conveyor structures and screen houses. The rather unusual looking but quite effective covering over the dust pile is of corrugated galvanized iron on wooden purlins and supported on wire rope cables

Two views of the trucking—at the shovel and dumping to primary crusher

the secondary road at a higher level passes between the recrushing plant and the primary crusher in the quarry. Hence two tunnels were cut out of the rock under the secondary road, one to connect the quarry with the main highway, and one for the main belt conveyor and return belt conveyor between the primary crusher and the recrushing building. The finally crushed material from the recrushing building is carried over the main highway on an inclined belt conveyor to the sizing screens on the other side.

Looking into the quarry at Oriskany Falls

Drilling in the quarry is done with a Loomis electric, wheeled-type, blast-hole drill, with the usual 5⅝-in. bit, and the holes have an average spacing of about 20 ft. back by 14 ft. apart. Approximately 23 tons of rock are obtained per foot of hole drilled, while the blasting ratio is about three tons of rock per pound of explosive. Secondary drilling is done with jackhammer type drills, air being furnished by a small Sullivan motor-driven compressor.

The rock is loaded by a 2-yd., Model 37, Marion caterpillar type electric shovel into type 104-C International trucks with Heil dumping mechanisms and specially designed, heavy, wide bodies. The bodies are 8 ft. wide by 13 ft. long on the bottom, with 5-in. cross I-beams covered with ¼-in. steel plate and 3-in. timber planks, which are in turn covered with ½-in. steel plate. No end gates are used, and they are now loaded to about 10 tons, although capable of hauling 18 tons. Since the primary crusher is depressed below the quarry floor, the haul is level and short (less than 500 ft.) so that two trucks satisfactorily take care of the quarry haulage.

Crushing and Screening

The trucks dump directly to a 36-in. by 48-in. Type C Buchanan jaw crusher, which discharges to a 36-in. by 168-ft. inclined belt conveyor carrying to the scalping screen. The Buchanan crusher is belt-driven from a General Electric motor, and the belt conveyor is driven through a Falk speed reducer by a 40-hp. G. E. motor with solenoid brake.

Scalping is done on a double-deck, 5-ft. by 8-ft. Niagara vibrating screen with Texrope drive, from an individual Fairbanks-Morse motor, and equipped with 5-in. mesh wire cloth on the upper deck, and normally with 3½-in. mesh cloth on the lower deck (a smaller mesh is used when not making ballast sizes).

The plus 5-in. material falls into a bin below with a side outlet through which it

A glimpse of the 66-ft. ledge revealing good stratification of the rock, and a 2-yd. electric shovel loading truck

Two views of the loading bins taken from opposite ends of the plant. At the left, the washing screen is shown in the foreground. Both railroad and truck loading is done at each bin

feeds by gravity to a No. 6 Gates gyratory crusher, and the 5-in. by 3½-in. material falls into a second bin from which it feeds in like manner to a 4-ft. Symons cone crusher. The recrushed material from both crushers is returned on an inclined 24-in. by 65-ft. belt conveyor to the main 36-in. conveyor and carried back to the scalping screen.

Both crushers have Texrope drives, with a 50-hp. G. E. motor on the No. 6 crusher and a 100-hp. G. E. motor on the Symons crusher. The return belt conveyor is driven through a Falk reducer by a 5-hp. Fairbanks-Morse motor.

All minus 3½-in. material passing through the lower deck of the scalping screen is spouted to a 24-in. by 160-ft. inclined belt conveyor which carries over to the finishing screens. This conveyor is driven by a 15-hp. Fairbanks-Morse motor through a Falk reducer.

Final sizing is done by six vibrating screens, including two Robins, two Niagara and two Universal, in connection with conveyors, and so located as to distribute the finished sizes along a space of some 250 ft.

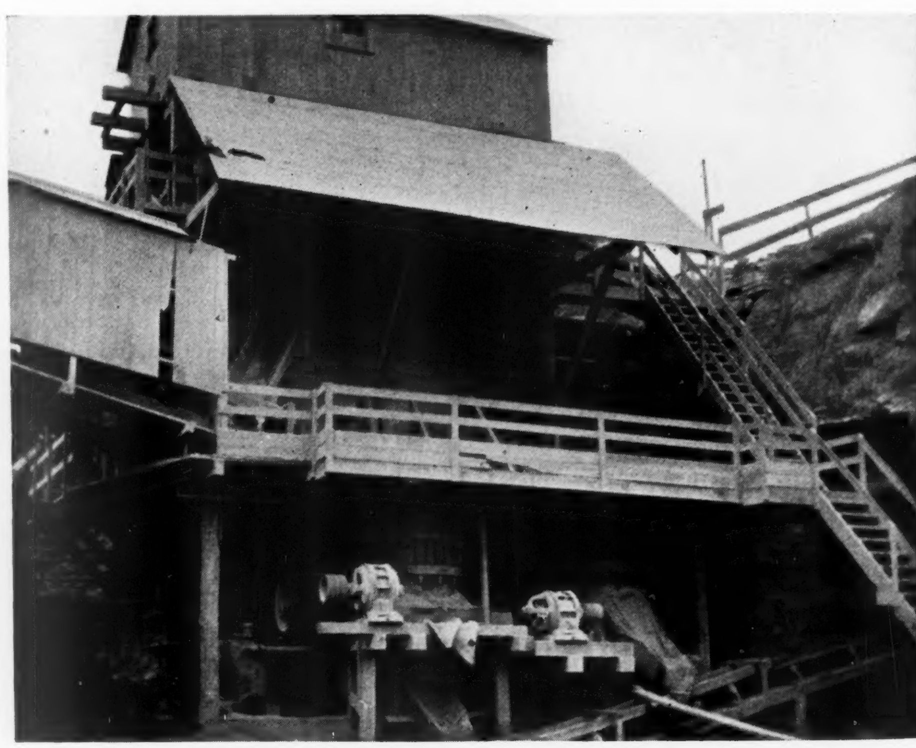
The material coming off of the belt conveyor for sizing is spouted first to a 5-ft. by 8-ft. double-deck, Robins screen with 1⅜-in. mesh wire cloth on the upper deck and ¾-in. mesh cloth on the lower deck. The 1⅜-in. by 3½-in. material passing over the upper deck is spouted to a 4-ft. by 6-ft. single-deck, Universal screen with 2¼-in. mesh cloth, where the 1⅜-in. by 2¼-in. passing through falls to one of the storage compartments as No. 3A, while the 2¼-in. by 3½-in. material passing over this screen is spouted to a 24-in. by 60-ft. belt conveyor and carried over for a further separation, which is done on a 2-ft. by 6-ft., single-deck, Niagara screen with 2¾-in. mesh cloth. Here the 2¼-in. by 2¾-in. size falls to one compartment and the 2¾-in. by 3½-in. size to another.

The ¾-in. by 1⅜-in. material passing over the lower deck of the 5-ft. by 8-ft. Robins screen is carried on an 18-in. by 40-ft. belt conveyor to a 3-ft. by 8-ft., single-deck, Universal screen with 1-in. mesh cloth, where two slightly different No. 2 sizes are separated out and fall to compartments below.

The minus ¾-in. material passing through the lower deck of the 5-ft. by 8-ft. Robins screen is spouted to a 4-ft. by 6-ft., single-deck, Niagara screen with ¼-in. mesh cloth, where the No. 0, or screenings, and the No. 1 or ¼-in. by ¾-in. are separated. The minus ¼-in. or dust, as it is commonly called, passing through this screen is carried out to a compartment beyond the No. 3 and ballast storages, while the ¼-in. by ¾-in. passing over the screen is carried in the opposite direction on an 18-in. by 110-ft. belt conveyor to a point beyond the No. 2 storage piles. Here it is discharged to a 4-ft. by 6-ft., single-deck, Robins Gyrex screen with ½-in. mesh, where it is separated into two sizes, No. 1 Special, ½-in. by ¾-in., and No. 1A, ¼-in. by ½-in.

Reclaiming and Loading

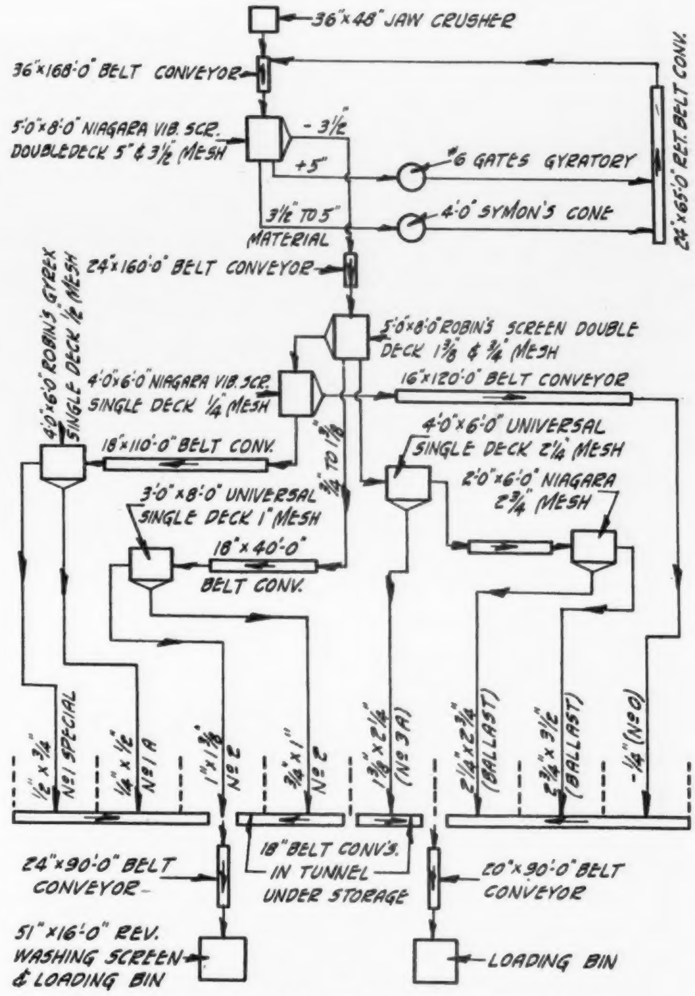
The various separations noted above permit the loading out of all standard as well as special sizes and of mixing as desired. Extending along under the full length of the storage piles is a reinforced concrete tunnel with two cross tunnels serving as outlets to the loading points. The main tunnel is 6-ft. wide by 6 ft. 5 in. high by 250 ft. long, with feed gates in the top, and contains four 18-in. belt conveyors. As indicated on the flow sheet, these conveyors discharge on to two inclined belt conveyors leading out to two separate loading points. The two loading points are about 125 ft. apart nad are arranged for both railroad and truck loading.



Scalping and recrushing building located between the primary crusher and the final screening operations. Note the accessibility and convenient arrangement of the recrushers

The sizes from 2¾-in. down (except the dust or minus ¼-in. product) are carried out on the 24-in. belt conveyor and are washed before loading by passing them through a revolving screen with 3/16-in. perforations located over the loading bin at that end of the storage. Two Morris centrifugal pumps with direct-connected 15-hp. Fairbanks-Morse motors furnish water at the rate of 600 gal. per min. for this purpose.

The ballast sizes and screenings at the other end of the storage are carried out on the 20-in. belt conveyor and loaded dry through the other bin.



Flow sheet of the Oriskany Falls operation, Eastern Rock Products, Inc.

General

The whole arrangement is such as to give considerable flexibility in operation and a well screened product, while requiring comparatively few men to operate. Practically any combination of sizes may be obtained by mixing on the loading belts under the storage piles.

An interesting detail of construction is the roof covering over the screenings or dust pile, which it has been found desirable to protect from the weather. As in other similar cases elsewhere, trouble was experienced with a rigid timber or steel frame work to support the roof, because of the pushing action of the material. To avoid this a simple and effective cover is used of corrugated iron sheets fastened to transverse wooden beams or purlins, and the whole supported on and clamped to wire cables anchored at each end and running up over a single frame or bent at the center, and having much the appearance of a tent open on the ends.

The belt conveyors are driven through Falk speed reducers by individual motors. Fairbanks-Morse motors are used almost entirely for the smaller drives, 15-hp. and less, while G. E. motors are used in the larger sizes.

The plant is served by the New York, Ontario and Western R. R. New railroad track scales are now being installed.

The crushing and screening capacity is about 2000 to 2500 tons per day, while as high as 3500 tons per day may be loaded out by using both loading points.

Eastern Rock Products, Inc., which is a merger of Boonville Sand Corp., Peerless Quarries, Inc., and Broome County Sand and Gravel Co., now operates ten plants, two of which are stone plants and the balance sand and gravel plants.

The Oriskany Falls plant produces crushed stone and rip rap, while the Munnsville plant also produces agricultural limestone in addition.

The plants at Boonville, Forestport, Solsville and Chenango Bridge are primarily sand plants, while both sand and gravel are produced at the Utica, Herkimer, Binghamton and Whitney Point plants. The plant at Utica, known as the Sterling Creek plant, is on the New York State Barge Canal, so that water shipments, as well as railroad and truck, are made from this plant. The various plants are served by the New York Central, New York, Ontario and Western, and the L. D. and W. railroads.

The main offices of the company are at 404 Court street, Utica, N. Y. Harold V. Owens is president and general manager, Albert S. Owens is vice-president and sales manager, and L. B. Gray and J. H. Wagoner are general superintendents.

American Road Builders' Assn. Picks St. Louis for 1931 Convention and Show

ST. LOUIS HAS BEEN CHOSEN as the site of the 1931 convention and road show of the American Road Builders' Association. This announcement, following the annual business meeting of the association and the installation of new officers in Washington, May 15-16, carries out the new policy of giving the annual gathering to a new section of the country each year. The Missouri metropolis was chosen over the rival bids of Houston, New Orleans and other cities of that region, because of what are thought to be superior facilities for accommodating the delegates and the mammoth exposition of road machinery and equipment, both of which lead the industrial field in point of size.

Another strong point in favor of St. Louis is its location in the very center of the midwestern and southwestern area, among the states that have the largest road building programs of the entire nation under way. A railroad center, St. Louis will be easily accessible to manufacturers, the majority of whom come from east of the Mississippi river, and to delegates and road building engineers who will attend from the entire country.

Meeting for the first time in more than a decade in a southern city, the convention will undoubtedly attract the largest representation in history of contractors, engineers and highway officials from not only the states which are far advanced with huge expenditures of funds for comprehensive road programs, but from others of the southern states which have lagged behind in the highway industry because of financial reasons and possibly a lack of thorough appreciation of what road building means in upbuilding of local resources and community life.

Those who sought the convention and road show for Houston have announced that they will redouble their efforts to secure the 1932 meeting, and it is thought that the association officials might welcome the opportunity to continue its traveling policy by going into another section of the South a year hence.

The executive committee of the association is convinced of thoroughly adequate hotel accommodations for all who may attend the St. Louis meeting, and they have been impressed with the commodious facilities for the convention meetings and for the Road Show exhibits offered by the Highlands Arena. The main arena and two adjoining exhibition buildings provide 247,800 sq. ft. of floor space for exhibit purposes, and a structure will be erected this year to house convention sessions.

Already requests for information regarding the 1931 Road Show have begun to come into association headquarters.

Studies of Sands and Mortars

Reviewed by Edmund Shaw
Contributing Editor, Rock Products

THE BULLETINS of the Maine Technological Experiment Station, connected with the University of Maine, Orono, Me., have added much to our knowledge of sands, cements and mortars. So far as the reviewer knows, these bulletins were the first to point out that sands are not nearly the inert materials they were assumed to be. It was, of course, long known that the mineralogical content of sand had some effect on the mortar strength but until the publication of some of these bulletins this effect was supposed to be negligible. Now we know that it is not negligible and that for purely chemical, or physio-chemical, reasons one sand may give a higher mortar strength with one cement than another, and that with all characteristics but the mineralogical content the same two sands may have differing mortar strengths with the same cement.

A striking example is given in *Bulletin No.* 23 of the Station, the title of which is "A Study of the Reliability and Prognostic Value of the Standard Tension and Compressive Tests for Sand Mortars." The authors are Weston S. Evans and H. Walter Leavitt, and the studies reported were made in co-operation with the U. S. Bureau of Public Roads. This is a statistical study and the effect mentioned is brought out only as one result, although it seems to the reviewer to be worth emphasis here.

The *Bulletin* says: "This study should throw some light upon the use of different cements with the same sand. It has heretofore been commonly assumed that the strength of the mortar would vary with the strength of the cement, other things being equal. This is evidenced by the common use of the standard Ottawa ratio to determine the fitness of a sand. As an illustration of an extreme case of the difference in behavior with different cements, refer to sand No. 848. On the original test a strength, as measured by the average of three briquets, of 195 lb. per sq. in. was obtained. On the check test this same sand with a different cement gave a strength of 425 lb. per sq. in. Moreover, with the first cement the strength dropped from 275 lb. at 7 days to 195 lb. at 28 days, although with the second cement it behaved normally. Sand No. 848 contained limestone and a detailed study of all the tests indicates that the first cement had similar effects on most sands similarly composed.

"In the case of sand No. 846 the condition of sand No. 848 is reversed. On the original test a strength of 410 lb. per sq. in. was obtained, although on the check test a strength of only 260 lb. per sq. in. was obtained. So another case of the influence of sand on cement is indicated. This type is not as easily identified as the previous one, but it does show that many sands may fall down with one cement although they may give satisfactory results with some other cement."

And farther on the bulletin says: "It is the opinion of the writers that the time is past when sand can be considered as an inert substance and the idea of a chemical reaction between sand and cement thrown to the winds. Such reactions are many and complicated, but in the near future their effect will be considered."

The reader of this *Bulletin No. 23* is referred to Yule's "Introduction to the Theory of Statistics" and to Kelley's "Statistical Methods" for an explanation of how the study of the tests was conducted. It is too complicated to describe here. The primary plotting was made on the test results of 100 sands each of which had been tested for tensile strength with three first briquets and three second briquets. These were plotted with the first briquets as ordinates and the second as abscissae and again with the order reversed, making six points for all possible combinations. The plot is shown in Fig. 1, the numbers in each square showing the number of points plotted in that square. The heavy dots represent the plotting for one sand. From such plots as this certain constants were worked out, such as: Mean 28-day tensile strength, standard deviation, correlation coefficient, probable error of prediction and a regression equation. In a second part compression strengths are studied in the same way.

From this study it is concluded that: "The tension test for sand is satisfactory in itself but two tests do not agree as their inter-relationship would warrant. The difference is probably due to a difference in cements.

"The actual 28-day strength of the sand may be determined more closely than the Ottawa ratio, even when different cements are used. It would be better to have an actual strength as 350 lb. for a criterion rather than a percentage of the same cement and Ottawa sand. This, of course, would lead to the testing of any sand with the cement to be used in the work for which

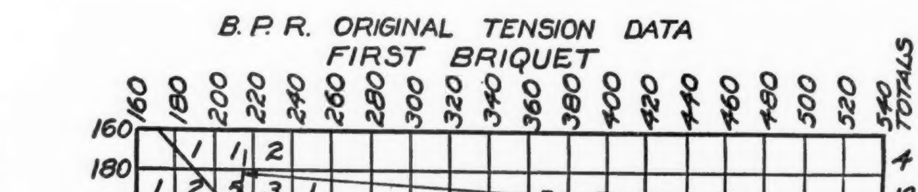


Fig. 1. Test results of 100 sands

the sand is being tested.

"If 7-day results in either the tension or compression tests are to be used as an indication of the 28-day results, a large factor of safety must be allowed.

"The compression test is in no way the equal of the tension test. . . . The effectiveness of a test which cannot be reproduced with greater accuracy than can the compression test is very doubtful.

"The unreliability of the compression test and the lack of correlation between the tension and compression tests shows the need of establishing the degree of relationship between both tests and the actual service of the resulting product."

One of the purposes for which the study described in *Bulletin No. 23* was undertaken is that of predicting the strength of a mortar made from a sand of which the characteristics are known. A study for the same end was described in *Bulletin No. 21* by J. W. Gowen and the authors of *Bulletin No. 23,* which was published in 1928. *Bulletin No. 24,* called "Sand Study No. 5," discusses additional factors in the prediction of tensile strength of sand mortars beyond those considered in *Bulletin No. 21.* These factors are the color shown in the A. S. T. M. colorometric test (for indicating the amount of organic matter in a sand), and the percentage of water used in making the mortar. This percentage is that "necessary to give a 1:3 mix of sand and cement a flow equal to that of a 1:3 mix of the same cement and Ottawa sand when mixed according to A. S. T. M. specifications. The percentage is always computed on the basis of a batch consisting of 750 grams of sand and 250 grams of cement. The flow is measured by the 'try by eye' method."

The original equation was founded on the gradation of the sand, constants plus or minus being given to the percentages remaining on different sieves of the Tyler standards used in finding the fineness modulus. All grains above No. 4 are screened out. No. 48 sieve is not used. Indicating the percentage remaining on any sieve by R, the plus constants are: R-No. 8, 3.97; R-No. 14, 1.52; and R (passing) 100, 0.24. The minus constants are, R-No. 28, 1.29; and R-No. 100, 5.24. The percentage of water used is a plus constant, 24.25, and the color is a minus constant, 73.73. An addition of 149.27 is made to the algebraic sum of these constants times the terms to which they apply and the whole sum is the predicted 28-day tensile strength of the mortar.

An example is given of a sand which has the following sieve analysis, which has a color test value of 1 and requires 10.4% of water to make a mortar of normal consistency.

Percent retained on No. 8 sieve	= 27
Percent retained on No. 14 sieve	= 36
Percent retained on No. 28 sieve	= 20
Percent retained on No. 48 sieve	= 9
Percent retained on No. 100 sieve	= 3
Percent passing No. 100 sieve	= 5

Multiplying these by the assigned constants given above we have:

		Plus	Minus
(R-No. 8)	27× 3.97=	107.19	
(R-No. 14)	36× 1.52=	54.72	
(R-No. 28)	20×—1.29=		25.80
(R-No. 100)	3×—5.24=		15.72
(Passing 100)	5× 0.24=	1.20	
Color	1×-73.73=		73.73
% Water	10.4× 24.25=	251.16	
To be added to all tests........		149.27	
		563.54	115.25

Then 563.54 — 115.25 = 448.29 lb. as the predicted 28-day strength of the mortar. The actual 28-day test was 498 lb. so the prediction was 50 lb. too low.

The *Bulletin* has tables for the values of R-No. 8, R-No. 14, etc., which lessen the work of calculation.

This method of prediction was tested out with 102 Maine sands. After correcting for the cement actually used (which raised the predictions 30.1 lb.) the average prediction was found to be 23 lb. too low. All the results are given in table form. Most of the predictions are not so far from the actual strength found in testing. A few are very close to it but 13 of the predictions are either too high or too low by more than 100 lb.

It appears to be the opinion of the authors that this method of prediction has value for determining quickly whether a sand is good enough to justify further testing but they conclude that there are other important factors which must be measured in order to make more accurate predictions.

Manufactured Rock Product Restricted from Use of Term "Sani-Onyx"

THE FEDERAL TRADE COMMISSION has ordered the Marietta Manufacturing Co., Indianapolis, Ind., to cease using the term "Sani-Onyx, a Vitreous Marble," or the term "Sani-Onyx," as a designation or description of the product manufactured by it.

The company is also directed to stop representing in its advertising matter or by other means that the product which it manufactures is marble or onyx.

Commissioner William E. Humphrey dissented from the action of the majority issuing the order in this case, declaring that he does not believe the evidence sustains the findings.

The commission says in its findings that "respondent's product is not a product of nature, but is a manufactured product, the chief ingredient of which is silica. It is neither marble nor onyx. It is manufactured in slab form and capable of being used in place of natural or quarried onyx or marble when such onyx or marble is in slab form. It is made in a great variety of colors, and in some of said colors the product resembles marble in appearance, and also in some of said colors it is somewhat similar in appearance to the type of onyx in slab form."

For 20 years the company has sold its product to jobbers, contractors, builders, and in some instances to the ultimate consumer, for use in building interior walls, wainscoting, ceilings, table tops, counters and the like. It is in competition with concerns selling articles of the same general class as well as marble and onyx cut and fashioned so as to be suitable for the same uses as the Marietta company's products.

The commission held that the respondent's designation of its product is false and misleading and has a tendency to deceive buyers into the belief that the product is onyx or marble.

Dissent of Commissioner W. E. Humphrey: "I do not disagree with my associates as to the law but as to the facts in this case. I do not think the evidence sustains the findings. Fortunately, for the determination of this question, if it is appealed, the court can examine all the material evidence in a few moments.

The advertisements and the product itself constitute the material evidence and all of it. In each of the advertisements quoted in the findings of fact, a statement is made that shows no possibility of leading anyone to believe that the product is either onyx or marble. Again, this product is almost exclusively sold the contractor, generally through the architect.

I cannot believe that anyone of ordinary capacity, using the ordinary care that one would naturally employ in making a purchase, would ever be deceived into thinking that he was purchasing either onyx or marble.

The term "Sani-Onyx" is really, under the circumstances of this case, a fanciful name. The trouble is that the people are not deceived by the respondent's product. They know what it is and they prefer it and they buy it. The sale of this product is not unfair competition but it is dangerous competition, because the product is cheaper and better suited for most purposes for which it is sold than either marble or onyx.

If the respondent, when it refers to its own product, shall use the word "made-marble," and the word "made-material," and, when it refers to onyx or marble, were to use the words "natural onyx" and "natural marble," the possibility of deception, if there be any, would be effectually removed. Certainly the respondent should be allowed this privilege.

It might be worth while to call attention to the fact that this trade name was adopted before the Federal Trade Commission act was passed, and for 20 years nobody has complained about it.

I think in this case the commission is promoting monopoly instead of competition.

Determining Solubility of Gypsum

By Wallace C. Riddell
Chemical Engineer, Standard Gypsum Co., San Francisco, Calif.

EXPERIMENTAL WORK on calcining gypsum in a Raymond kiln mill suggested that different methods of calcination produced materials of variable solubility, and indicated the possibility of producing calcined gypsum of high activity.

This method of calcination was developed in a western mill several years ago and is still in the experimental stages. The process consists of pulverizing gypsum in a special hammer type mill which is completely surrounded by a suitable fire box. The mill, when heated to its operating temperature, is supplied with crude gypsum which is pulverized to standard finenesses and at the same time liberated of a part of the water of crystallization.

The mill is connected to a suitable fan and cyclonic dust collectors; the latter may if necessary be insulated. When the gypsum, being pulverized, has reached the predetermined fineness the fan carries the material out of the pulverizer.

Solubility determinations have been made on various samples of gypsum and the several important products resulting from the calcination of gypsum. The solubility of natural anhydrite was also determined. The results are only approximate, as the purest sample of natural anhydrite obtainable contained over 5% of gypsum.

The method used in determining solubility was as follows: 10-g. samples were weighed and brushed into 300-cc. flasks; 250 cc. of distilled water added and the flask agitated for 5 minutes. The sample was then filtered through a Buechner funnel and the amount of soluble calcium sulphate was determined, in 100 cc. of the filtrate at 75 deg. F., by precipitation as $BaSO_4$.

The total time for agitation and filtration was controlled to a period of approximately 10 minutes as gypsum crystals formed rapidly in some solutions, especially those of high solubility. The following tests on a sample of gypsum indicate that a period of 10 minutes gives fair results:

Total agitation and filtration time	Grams $CaSO_4$ per 100 cc. solution
5 minutes	0.212
10 minutes	0.220
30 minutes	0.224
90 minutes	0.211

Hulett and Allen (*Z. Phys. Chem.* 1901, **37**, 391) give the solubility of gypsum, $CaSO_4 \cdot 2H_2O$, as 0.2080 g. $CaSO_4$ per 100 cc. at 25 deg. C.

Jolibois and Chassevent (*Comp. rend.* 1924, **178**, 1543) report the solubility of $CaSO_4 \cdot \frac{1}{2}H_2O$ as 0.88 g. $CaSO_4$ per 100 cc. at 20 deg. C.

Table No. I gives the results of solubility tests on the three different rock gypsums; one natural anhydrite from northern Nevada and six calcined gypsum products that were treated as indicated in the table.

Table No. II gives an analysis of three rock gypsum samples from western deposits that indicate the character of the rock used in the experimental work.

Averaging all the solubility determinations made gives the following results:

	Grams $CaSO_4$ per 100 cc. H_2O at 75 deg. F.
Average for gypsum, $CaSO_4 \cdot 2H_2O$	0.22
Average for calcined gypsum, approximately $CaSO_4 \cdot \frac{1}{2}H_2O$	0.74
Average for soluble anhydrite, $CaSO_4$	0.77
Average for natural anhydrite, $CaSO_4$	0.13

Samples of gypsum were calcined at various temperatures and the solubility determined. The results were as follows:

Calcined gypsum, 1 hour at	Solubility, g. $CaSO_4$ per 100 cc.
300 deg. F., combined H_2O = 5.10	0.762
400 deg. F., combined H_2O = 0.11	0.765
500 deg. F., combined H_2O = 0.0	0.786
600 deg. F.	0.753
700 deg. F.	0.376
1000 deg. F.	0.290
1200 deg. F.	0.251
1500 deg. F.	0.220
1800 deg. F.	0.200

The results indicate that a marked change in solubility occurs between 600 deg. and 700 deg. F. Results of setting-time and other tests suggested a change in solubility at this temperature.

Change of solubility by the addition of various substances give interesting results of practical importance. For example, the addition of 0.5 gram of sodium chloride changes the solubility of gypsum $CaSO_4 \cdot 2H_2O$ to 0.25 grams $CaSO_4$ per 100 cc.; and the addition of 0.5 gram of sodium chloride to calcined gypsum approximating $CaSO_4 \cdot \frac{1}{2}H_2O$ to 0.86 grams of $CaSO_4$ per 100 cc.

The setting-time of calcined gypsum varies with the solubility.

The high solubility of calcined gypsum made by the Raymond kiln mill process suggested its use as a method of calcining gypsum as a retarder for portland cement.

Calcium sulphate used as Keene's cement has a solubility approximating that of gypsum. This accounts for its slow rate of setting. Calcined gypsum having a lower solubility than that of $CaSO_4 \cdot 2H_2O$ sets at too slow a rate to be of technical value as a cement.

The reaction of calcium sulphate in portland cement is determined by the rate and amount of solubility. The difference in solubility between anhydrite, calcined gypsum, soluble $CaSO_4$ and gypsum $CaSO_4 \cdot 2H_2O$ and their reaction with certain portland cement clinkers have been studied. Under certain conditions, calcium sulphate of high solubility has proved to be advantageous.

TABLE NO. I

Material	Combined water	Solubility, grams $CaSO_4$ per 100 cc. at 75 deg. F.
Rock gypsum from Lower California	20.34%	0.220
Rock gypsum from northern Nevada	19.90	0.213
Rock gypsum from southern Nevada	20.40	0.222
Natural anhydrite from northern Nevada	1.90	0.138
Calcined gypsum, kettle process, 340 deg. F. Plant A	5.17	0.749
Calcined gypsum, kettle process, 340 deg. F. Plant B	4.80	0.722
Calcined gypsum, Raymond kiln mill process	4.65	0.810
Pure $CaSO_4 \cdot \frac{1}{2}H_2O$, calcined in electric oven at 250 deg. F.	5.81	0.718
Keene's cement	......	0.266
Soluble anhydrite, $CaSO_4$	......	0.786

Analyses of the gypsum samples used were as follows:

TABLE NO. II

	Southern Nevada	Northern Nevada	Lower California
Insoluble (silica and silicates)	0.75	0.85	0.90
Iron and aluminum oxides, $Fe_2O_3 + Al_2O_3$	trace	0.20	trace
Calcium carbonate, $CaCO_3$	0.80	2.50	0.75
Calcium sulphate, $CaSO_4$	77.50	76.20	77.50
Combined water, H_2O	20.40	19.90	20.37
Total	99.45	99.65	99.52
Gypsum content, $CaSO_4 \cdot 2H_2O$	97.50	95.1	97.37
Anhydrite	0.40	1.0	0.50
Fineness passing 100-mesh	97%	96%	95%

Laboratory Control of Feldspar Production and Preparation

"Standardizing" for Various Uses a Product That Occurs in Nature with a Great Variety of Compositions

By W. A. Seger
Consolidated Feldspar Corp., Trenton, N. J.

> ### *Editor's Note*
>
> ***WE print two articles about feldspar that should prove just as interesting and helpful to LIME manufacturers and users as to feldspar producers and users. For, notwithstanding the vast differences in minerological character, preparation and uses between feldspar and lime, there is a very close parallel in the possible STANDARDIZATION of the two commodities. Both lime and feldspar occur in nature in as many varieties as there are deposits.***
>
> ***Lime manufacturers have always contended that lime can't be standardized because that made from each limestone has its pecularities. Yet lime is a refined product, even in a greater sense than commercial feldspar. The chemical and physical differences in feldspars are even more important, if anything, to the consumer than chemical and physical differences in limes. Yet feldspar producers and consumers have got together and STANDARDIZED feldspars. Why can't limes be standardized for various uses in the same way?***
>
> ***The feldspar industry has long been beset with the same difficulties the lime industry is contending with—hosts of small, irresponsible producers and NO CONTROL of the quality of the output. Evidently the feldspar industry has found the way out. Why not lime manufacturers? So we hope no lime manufacturer will pass up this article because it happens to be captioned "Feldspar." — The Editor.***

FELDSPAR is a general term applied to a most important group of rock forming minerals; it is igneous in origin and appears in pegmatite formations of crystalline rock masses with other minerals. As our interest in this article is with commercial rather than geological phases of the mineral, the subject will be further treated from that angle.

The principal producing regions of feldspar in North America are in western North Carolina, Maine, eastern Canada, New Hampshire, Connecticut, New York, Virginia, Maryland, South Dakota, Colorado, Arizona and California. The larger proportion of the material now used is mined in the East, although certain western deposits are of a very high grade.

Feldspar is ordinarily found in conjunction with quartz, mica, and other minerals in smaller quantities. From a commercial standpoint these other minerals are undesirable and must be removed by various refining processes in the production of the feldspar. Most of the feldspar produced is open quarried, although there are a few underground operations. The cost of open-quarrying is naturally lower than the other method, besides other advantages to be gained.

The specifications covering commercial feldspar have, during the past few years, become more rigid and exacting and it has consequently been necessary for producers of this commodity to provide means of accurately controlling their outputs. It follows naturally that the producer capable of furnishing the most uniform high quality products is in a better position to compete for business than those still operating under obsolete "hit or miss" methods. The gage of quality as applied to feldspar is primarily uniformity from shipment to shipment of a material which is free of contaminations.

Achieving Uniformity of Output

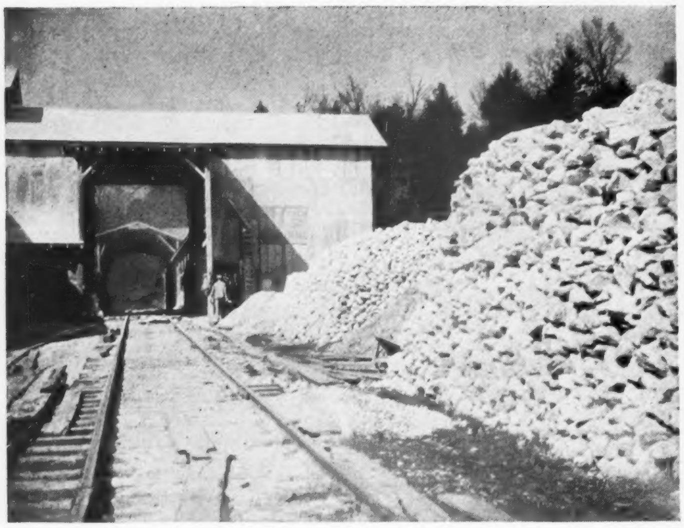
To achieve this important factor of uniformity the utmost care must be exercised in each step of preparation. A brief description of a modern operation is as follows:

As the crude mineral is mined, a primary selection is made, the object of which is to remove the larger quantities of undesirable mineral. The rock is then transported to a crusher from which it passes through a washer, removing all loose particles, and to a long picking belt. On either side of this picking belt are stationed operators trained in the selection of the different grades of material passing before them on the belt. (The percentage of salable product which can be extracted from the total quantity mined will vary with the mine and in the same mine at different times, but a liberal estimate of the average reclaimed is 30%. The nature of the waste product which passes to the dump is in large part quartz with conglomerations of mica, hornblende, etc.)

Different grades, as they are picked from the belt, are dropped into chutes emptying into temporary storage bins. On the arrival of the product in this condition at the mill it is passed through a secondary jaw crusher, and in some cases also through a roll crusher, reducing it to approximately ½-in., and then through a dryer. A system of elevators and conveyors discharges the material into one of several large storage bins assigned to particular grades of product. As these bins are being loaded, a sampling device removes a small portion constantly; this sample is later ground and analyzed and the analysis posted on the filled bin of which the sample represented an accurate cross-section. Discharge from these storage bins in quantities accurate to the pound permits of controlling the composition of the material which is to be ground. On being discharged from the storage bins a large mixing bin next handles the product before it enters the grinding mill.

Several types of mill and methods of grinding are in use, and the modern plant is equipped to meet the particular desires of its customers in the matter of employing the method preferred by them. Particular care is taken in each of the steps of handling to pass the material over suitable equipment for the removal of all magnetic iron, as in most of the uses to which feldspar is put the presence of iron produces "specking" or other undesirable results.

It is now a generally accepted fact that feldspar taken from the same deposit will have a greater tendency toward uniformity than that originating in several mines. It is obviously good practice, therefore, if the maximum service is to be rendered the customer, to supply in each shipment material which will be not only chemically but also mineralogically identical with previous shipments. Any feldspar deposit, by reason of the nature of the mineral and the condition in which it occurs in nature, will show a slight variation in the chemical composition of the output in different parts of the mine and at different times. In spite of this slight variation, however, the material from any given mine will possess certain physical characteristics due to its mineralogical make-up which will not necessarily be possessed by another material similar in chemical composition but from a different deposit.



Scenes from a feldspar mill at Erwin, Tenn., showing method of crude storage and a glimpse into the laboratory

The assurance of the consumer's obtaining a uniform product is therefore dependent upon the ability of the producer to supply him with a product taken from the same mine and subjected to rigid control in its handling over an extended period of time. It therefore behooves the consumer to obtain his supply from the producer who owns and controls the most extensive deposits and is equipped to exercise the necessary care in processing the material.

Laboratory Control Essential

If the requisite control is to be maintained, extensive laboratory facilities are required and only the large and financially strong producing companies are capable of supporting laboratories adequately equipped and with capable technical personnel.

As there are varieties in the composition of the product so are there also numerous specifications to be met as regards particle size of the ground material. Consumers using the product for one purpose will require the material to be ground so that practically all of it will pass a 325-mesh screen, whereas for other uses a granular product is required.

It is convenient and advisable to carry on hand stocks of standard grades of the processed feldspar, but the producer must also be equipped to turn out a product to meet particular specifications accurately and on short notice. Consequently a large percentage of the feldspar produced is ground on receipt of orders to meet the requirements specified by the customer. Most shipments are made in bulk carload lots, although appreciable quantities are supplied in bags, either burlap or multi-wall paper, depending on the particular requirements of the individual customer.

The uses to which feldspar is put are many and varied. It is used in ceramic products as a flux and binder and is present in all clay products from the most delicate and threadlike pieces of porcelain to cumbersome pieces of sanitary ware. It finds an important place in all classes of porcelain enamel, glass, terra cotta, vitreous and semi-vitreous chinaware, electrical porcelain enamel, glass, terra cotta, vitreous and semi-vitreous chinaware, electrical porcelain, tile and other ceramic products. It is used in the manufacture of false teeth, as an abrasive in cleaning compounds and as a filler in certain high grade linoleums. It is present in many of those articles which play an important part in the comforts and conveniences of our daily life and has been aptly termed the "Jack-of-all-Trades" in the mineral family.

The 1929 Production of Feldspar in the United States

THE CRUDE FELDSPAR sold or used by producers in the United States in 1929 amounted to about 197,699 long tons, valued at $1,276,640, or $6.46 a ton, according to reports obtained directly from producers by the United States Bureau of Mines, Department of Commerce, in co-operation with the Geological Surveys of Maryland, New York, North Carolina, South Dakota and Virginia. These figures show a decrease of 6% in quantity and 10% in total value compared with 1928.

Feldspar was mined and sold in 1929 in 12 states, namely, Arizona, California, Colorado, Connecticut, Maine, Maryland, New Hampshire, New York, North Carolina, Pennsylvania, South Dakota and Virginia. The greatest feldspar producing region is that which includes the Atlantic Seaboard states, from Maine to North Carolina. This region reported about 91% of the total quantity and value in 1929. North Carolina, the leading state, reported about 52% of the total output; New Hampshire, the second state, reported 16%; and Maine, the third state, 10%. The average value per long ton in North Carolina was $5.80; in New Hampshire, $7.49; and in Maine, $7.10.

Except for minor purposes, feldspar is prepared for use by grinding. This work is done principally by commercial mills; only a very small portion is ground by users in their own mills. In 1929 there were 33 commercial mills operated in 13 states, namely, California, Connecticut, Illinois, Maine, Maryland, New Hampshire, New Jersey, New York, North Carolina, Ohio, South Dakota, Tennessee and Virginia.

CRUDE FELDSPAR SOLD OR USED BY PRODUCERS IN UNITED STATES IN 1928 AND 1929

State	1928 Long tons	1928 Value*	1929 Long tons	1929 Value*
Arizona	†	†	†	†
California	11,891	$81,199	12,770	$84,567
Colorado	†	†	†	†
Connecticut	6,292	48,996	2,726	21,056
Maine	25,063	202,219	19,992	142,042
Maryland	2,349	10,325	2,624	19,610
New Hampshire	30,343	236,224	30,964	231,810
New York	13,971	120,559	12,696	103,531
North Carolina	105,560	630,042	103,273	598,938
Pennsylvania	2,052	8,851	†	†
South Dakota	†	†	†	†
Virginia	†	†	6,677	38,628
Undistributed	13,290	80,560	5,977	36,458
	210,811	$1,418,975	197,699	$1,276,640

*Value at mine or nearest shipping point. †Included under "Undistributed."

These mills reported 230,582 short tons of ground feldspar sold in 1929, valued at $3,296,252, or $14.30 a ton, compared with 227,657 tons, valued at $3,459,028, or $15.19 a ton, in 1928, an increase of 1% in quantity but a decrease of 5% in value.

Of the quantity sold in 1929, 209,808 short tons, valued at $2,880,824, or $13.73 a ton, was domestic feldspar, and 20,774 tons, valued at $415,428, or $20 a ton, was imported feldspar. Imported feldspar was ground in two states in 1929 — New York and Ohio.

Commercial Standard Classifications for Feldspar Recently Adopted

THROUGH CO-OPERATION of representative producers of feldspar and representative users or consumers, with the assistance of the United States Bureau of Standards, the following commercial standard classifications for feldspar have been adopted recently:

I. Scope

This commercial standard classification covers ground feldspar used in the production of ceramic products, based on particle size and chemical composition. It is to be regarded as a classification rather than a definite purchase specification.

II. General Requirements

All screen tests shall be made on standard screens (U. S. Standard Sieve Series), the opening sizes of which are appended in Table I. A standard method of screen testing is described.

A standard method of chemical analysis is described.

III. Detail Requirements

A. PHYSICAL CLASSIFICATION BASED ON FINENESS OF GRINDINGS*

TABLE 1

U. S. standard sieve series number	Percentage remaining on No. 200 sieve	Maximum percentage on sieve designated	U. S. standard sieve series, opening in in.
230	0.00– 0.35	1.0	.0024
200	0.35– 1.00	1.0	.0029
170	1.00– 2.50	1.0	.0035
140	2.50– 5.00	1.0	.0041
120	5.00– 9.00	1.0	.0049
100	9.00–14.00	1.0	.0059
80	14.00–21.00	1.0	.0070
60	21.00–30.00	0.6	.0098
40	30.00–42.00	0.3	.0165
20	42.00–62.00	None	.0331

*Fineness classification shall be made on a basis of the percentage remaining on the standard 200 sieve and that remaining on the sieve designated. Example: 140 sieve product will have 2.5–5.0% remaining on the 200 sieve and less than 1% on the 140 sieve.

B. CHEMICAL CLASSIFICATION BASED ON COMPOSITION AS IT INFLUENCES USE

1. The first group includes the commonly accepted ceramic or body grades based on silica content and alkali ratio and containing less than 4% soda (Na_2O) content.

2. The numbers designated herein are for the purpose of illustration and the various groups may be added to up or down the scale to provide for all commercial grades of feldspar.

3. The silica number and ratio numbers are to be used in combination. For example: Grade No. 67-51 designates a spar of silica content 66.00 up to 67.99% and with 5 or more parts of potash (K_2O) to 1 part of soda (Na_2O).

Number	Silica (SiO_2) content
65	64.00-65.99%
67	66.00-67.99%
69	68.00-69.99%
71	70.00-71.99%
73	72.00-73.99%

Number	Potash (K_2O)—Soda (Na_2O) ratio
61	6 or more potash to 1 soda.
51	5 potash to 1 soda up to 6 potash to 1 soda.
41	More than 3 and less than 5 potash to 1 soda.
31	3 or less potash to 1 soda.

4. The second group includes the spars used chiefly for glazing purposes which are based on soda content and contain 4% or more soda (Na_2O).

Number	Soda (Na_2O) content
4	4.00-4.99%
5	5.00-5.99%
6	6.00-6.99%
7	7.00-7.99%
8	8.00-8.99%

5. The third group includes the spars used for glass making purposes and are based on silica, alumina and iron content.

6. The numbers are to be used in combination, for example grade 69-17-X represents a grade of spar of 68.00-69.99% silica, 17.00-17.99% alumina, and with a maximum of 0.15% Fe_2O_3 content.

Number	Silica (SiO_2) content
65	64.00-65.99%
67	66.00-67.99%
69	68.00-69.99%
71	70.00-71.99%

Number	Alumina (Al_2O_3) content
15	15.00-15.99%
16	16.00-16.99%
17	17.00-17.99%
18	18.00-18.99%
19	19.00-19.99%

Number	Iron (Fe_2O_3) content
X	A maximum of 0.15%
XX	A maximum of 0.20%
XXX	Above 0.20%

IV. Standard Methods of Test

A. PHYSICAL TEST

7. *Mesh or Fineness*—A 100-gram portion of the dry sample is weighed out to an accuracy of 0.1 gram. It is then transferred to the 200-mesh sieve and over a sieve pan which fits closely. The pan shall contain sufficient water to reach within not less than ¼ in. or more than ¾ in. from the top of the pan. The sieve and pan shall be vibrated or shaken in such a manner that water in the pan is splashed on the screen from below, so as to wash the powder about and cause the material that can pass through the sieve to pass into the pan below. This treatment shall be continued until no appreciable amount is passing through. The contents of the screen are then washed into a pan and thoroughly dried. The dried material is then placed on the coarsest sieve to be used. The finer screens including the 200-mesh are placed in order of size under the coarsest, the 200-mesh being at the bottom. The tier of screens is then shaken until no more than 0.05 of a gram passes any screen until after one minute of shaking each time. This point is determined by weighing the residue on the coarsest screen, reshaking for a minute until finished, then going to the next size and repeating the process.

B. CHEMICAL TESTS—GENERAL

8. Feldspar is analyzed for SiO_2, "R_2O_3," "Al_2O_3," Fe_2O_3, CaO, MgO, K_2O, Na_2O, and ignition loss. SiO_2, "R_2O_3," CaO, MgO, K_2O and Na_2O are determined in 0.5-g. samples. Ignition loss is determined in a 5-g. sample. Fe_2O_3 is determined potentio-metrically in a 10-g. sample and the result is subtracted from the percentage of "R_2O_3" to give "Al_2O_3." The result for the latter will of course include constituents such as TiO_2, ZrO_2, P_2O_5 and the like.

9. Accurate results in the analysis of feldspar are not easy to obtain, especially in the cases of SiO_2 and "R_2O_3." Attention must be paid to all details. Variations in check analyses should be within the following limits, SiO_2, 0.2%; "R_2O_3," 0.2%; CaO, 0.5%; MgO, 0.05%; K_2O plus Na_2O, 0.2%.

10. Analyses should be repeated if the summation does not fall between 99.75 and 100.5%.

11. Analyses of potash feldspars should be checked against the Bureau of Standards Standard Sample No. 70, and analyses of soda feldspars should be checked against the Bureau of Standards Standard Sample No. 99.

12. All results should be corrected by blank runs on reagents and factors should be calculated from the current International Table of Atomic Weights.

PROCEDURES—PREPARATION OF SAMPLE

13. The sample should be ground to pass a No. 100 screen and then well mixed. All samples for analysis must be taken from material that has been dried at 105-110 deg. C.

IGNITION LOSS

14. Weigh a 5-g. sample in a 30-ml. platinum crucible. Cover the crucible with a well fitting cover, and heat for 15 minutes at 1000 deg. C. The heating can be done over a burner or in a muffle and should be sufficiently gentle at the start so that there is no danger of mechanical loss. Cool over a good desiccant and weigh. The loss in weight multiplied by 20 represents the per cent of ignition loss.

SiO_2, "R_2O_3," CaO AND MgO

15. Weigh a 0.5-g. sample in a 30-ml. platinum crucible and add 4.0 g. of anhydrous sodium carbonate. Mix thoroughly with a small spatula and clean off the spatula. Cover the crucible, gradually heat to about 1000 deg. C, and continue the heating at this temperature, usually about 15 minutes, until the melt is quiescent.

16. Remove the cover, grasp the crucible near the top with a pair of platinum-tipped crucible tongs and gently rotate the crucible so that the melt solidifies in a thin layer on the inside of the crucible. Replace the cover, and allow the crucible to cool. When cool, remove the cover, invert the crucible over a 300-ml. evaporating dish and loosen the melt by tapping on the bottom of the crucible.

17. It is preferable that the evaporating dish be of platinum or of platinum-lined gold. If a porcelain dish is used it must be free from crusted rims on the inside, and especial care must subsequently be taken to remove all silica. If the melt does not loosen readily reheat and again cool.

18. Wash the crucible and cover with hot water to remove adhering particles, allowing the water to drain into the dish containing the melt. Add enough hot water to total 100 ml. and break up lumps by pressing with a blunt stirring rod. When disintegration is complete, cover the dish with a cover glass

and through the lip add 20 ml. of concentrated hydrochloric acid. This should be measured in the fusion crucible and introduced carefully so as to avoid loss by too rapid effervescence. Make sure that the crucible and cover are now clean.

19. Warm the evaporating dish, remove and wash the cover and the sides of the dish as soon as effervescence ceases, and evaporate the solution to *dryness* on the steam bath. Remove the dish from steam bath, cover and drench the residue with 10 ml. of concentrated hydrochloric acid. Let stand 1-2 minutes, add 100 ml. of hot water, remove and rinse the cover, and heat on the steam bath for 5 minutes. Filter through a 11-cm. No. 42 Whatman, or equivalent paper, catching the filtrate in a 600-ml. Pyrex beaker. Transfer as much of the silica as can be removed by rinsing the dish with hot dilute hydrochloric acid (5:95). There is no need to scrub the dish at this time. Wash the paper and silica with six 10-ml. portions of the hot dilute acid and then with ten 10-ml. portions of hot water at each washing, the solution should be first directed around the edge of the filter paper and then spirally down in order to churn up the silica. Reserve the paper and silica.

20. When the washing is finished, transfer the filtrate to the evaporating dish, rinse the beaker, and again evaporate the solution to dryness. When dry, cover, place the dish in a constant temperature oven and bake for 15-30 minutes at 105-110 deg. C. Remove the dish from the oven, drench the residue with 5 ml. of concentrated hydrochloric acid and warm on the steam bath for 1-2 minutes. Add 50 ml. of hot water, rinse off the cover glass, and filter on a 9-cm. paper. Scrub the dish thoroughly with small portions of cool dilute hydrochloric acid (1:99), each time using the portion to rinse the paper and residue. When all of the silica has been transferred wash the paper and residue with five 10-ml. portions of warm water. Reserve the filtrate for the determination of "R_2O_3," etc.

DETERMINATION OF SiO_2

21. Remove the filter papers containing the silica from the funnels and place in a weighed clean 20-ml. platinum crucible. Heat gently until the papers and contents are dry, increase the heat so that the papers char without flaming, and then burn the carbon at as low a temperature as possible. Cover the crucible with a well-fitting cover and heat at 1200 deg. C. for 15 minutes. If a blast lamp is used, the crucible should be sunk for two-thirds of its depth in an asbestos shield to prevent loss of the light fluffy silica by drafts from the blast. Cool over a good desiccant and weigh. Repeat the heating until constant weight is obtained. Moisten the silica with a few drops of water, add 2 drops of dilute sulphuric acid (1:1) and then 10 ml. of hydrofluoric acid. Carefully evaporate until fumes of sulphuric acid are given off and then still more carefully until the sulphuric acid has been expelled and the sulphates of iron, aluminum, etc., decomposed. Finally heat at about 1000 deg. C. for about five minutes, cool in a desiccator and weigh. The difference in weights between the crucible with the silica and the crucible after the treatment with hydrofluoric acid represents the weight of the silica obtained in the two evaporations. A small amount of silica, usually not much more than 1 mg., still remains in solution and is subsequently caught in the "R_2O_3." In analyses of the highest accuracy this is recovered by fusing the "R_2O_3," with pyrosulphate, dissolving the melt in sulphuric acid, evaporating to fumes, diluting with water and immediately filtering and washing. To obtain the percentage of silica, multiply the weight of silica found by 200.

22. If the residue left in the crucible after the volatilization of the silicon weighs no more than 3 mg. and is amorphous rather than glassy (as is the case in proper work) it can be considered as "R_2O_3" and weighed together with the precipitate obtained in determination of "R_2O_3." If the residue is heavy, or appears to be fused (alkali salts) the determination of silica is open to question. In order to avoid error in the determination of "R_2O_3" the residue must be fused with 1 g. of sodium carbonate, the melt dissolved in dilute acid and added to the filtrate from the silica.

DETERMINATION OF "R_2O_3"

23. Cover the beaker containing the filtrate from silica determination and heat to boiling. Remove from the hot plate, add two drops of methyl red indicator solution and then add 1:1 ammonium hydroxide dropwise and with stirring until the solution turns distinctly yellow. Return the beaker to the hot plate and boil for one or two minutes. The solution should remain yellow. Filter immediately on a No. 589 S. & S. black ribbon, or similar filter paper, catching the filtrate in another 600-ml. Pyrex beaker. Wash the beaker, precipitate and filter paper with two or three small portions of a hot 2% solution of ammonium chloride. Remove the precipitate from the filter paper with a jet of hot water, washing it into the beaker in which the precipitation was just made. Dissolve the precipitate in 25 ml. of hot dilute hydrochloric acid (1:1). Dilute to 200 ml. with hot water, add the filter paper, rinse the funnel with a little acid and water and stir the solution until the paper is pulped. Repeat the precipitation as before using methyl red and dilute ammonium hydroxide. Filter and wash thoroughly with 200 ml. of the hot 2% solution of ammonium chloride. Keep the filter paper nearly full of the wash solution. Make sure that the transfer of the precipitate is complete and reserve the filtrate for use in determination of calcium oxide.

24. Place the paper and precipitate in a weighed platinum crucible (see determination of SiO_2) and heat gently over a burner or in an open muffle, until the filter paper has burned without flaming and the residue is perfectly white. Finally heat at 1200 deg. C. for half an hour. Cool in a desiccator containing concentrated sulphuric acid, and weigh. Ignition of "R_2O_3" at 1200 deg. C. is very necessary to affect complete dehydration. The cover of the crucible must be tight-fitting and the weighing must be made rapidly. Ignited alumina is a more powerful desiccant than calcium chloride. The weight of the ignited residue multiplied by 200 represents the percent of "R_2O_3" in the sample.

DETERMINATION OF CALCIUM OXIDE

25. Acidify with hydrochloric acid the slightly ammoniacal filtrate reserved in the determination of "R_2O_3" and evaporate to a volume of about 200 ml. Heat to boiling, make slightly ammoniacal and add dropwise while still boiling, 10 ml. of a saturated solution of ammonium oxalate. Remove the beaker from the hot plate and digest on the water bath for one-half hour. Remove and allow to stand for one hour, or until cool. When the precipitate has settled, filter and transfer all of the precipitate by scrubbing and the use of a 0.1% solution of ammonium oxalate. Finally wash the paper from the rim downwards with ten 10-ml. portions of the wash solution. Reserve the filtrate for the determination of magnesia. Place the paper and precipitate in a weighed platinum crucible and ignite carefully until carbon has been destroyed. Cover with a well-fitting cover, ignite at about 1000 deg. C., cool over a good desiccant and weigh. The weight multiplied by 200 represents the percent of CaO in the sample.

DETERMINATION OF MAGNESIA

26. The volume of the reserved solution will be nearly 300 ml. Render barely acid with hydrochloric acid and add 0.5 g. of diammonium hydrogen phosphate. Make slightly alkaline with ammonium hydroxide and then add one-ninth the total volume in excess. The beaker may now be placed in an ice bath or stream of cold water which tends to hasten the precipitation. A minimum of four hours is required for the complete precipitation. If time permits the solution should be allowed to stand over night.

27. Filter, transfer the precipitate to the paper, scrub the beaker until free from precipitate and then wash the precipitate ten times with 10-ml. portions of dilute ammonium hydroxide (5:95). Place paper and precipitate in a weighed platinum crucible and dry in a drying oven or over a small flame. Char the paper without flaming, burn the carbon at as low a temperature as possible, and then ignite at 1100 deg. C. until constant weight is obtained. The weight of the ignited residue multiplied by 72.42 represents the percent of magnesia in the sample.

DETERMINATION OF ALKALIES (K_2O AND Na_2O)

28. Grind 0.5 g. of the sample to an impalpable powder in an agate mortar, taking care to avoid mechanical loss by dusting or otherwise. Add 0.5 g. of ammonium chloride and grind the mixture until thoroughly mixed. Add 3 g. of precipitated calcium carbonate (for alkali determinations) and mix thoroughly. Transfer to a glazed paper and from this to a 25-ml. crucible (A. J. L. Smith crucible is better). Clean the mortar, pestle and paper with 1 g. of the calcium carbonate and add to the contents of the crucible. Cover the crucible with a snugly fitting cover and place it in a hole in a ⅛-in. thick asbestos board so that a little less than half of the crucible sticks through. Heat the bottom of the crucible so gently that the odor of ammonia is just distinguishable. Gradually raise the heat until ammonia cannot be smelled, then sinter for one hour at about 900 deg. C. During this period it is desirable to put a small beaker of water on the crucible cover. Cool, transfer the sintered cake to a 250-ml. casserole, slake and add 100 ml. of hot water, nearly fill the crucible with hot water, warm, and add the solution to the solution in the casserole. Let settle somewhat, and filter by decantation upon a 9-cm. filter and catch the filtrate in a 1000-ml. casserole. Keep as much as possible of the residue in the dish. Add 50 ml. more of hot water, break up lumps by gentle pressure with a pestle, let settle, and again decant. Repeat the extraction six times.

29. To the filtrate, of approximately 500 ml. volume, add 20 ml. of a saturated solution of ammonium carbonate, cover, and heat on a steam-bath. Add small portions of the ammonium carbonate solution until it is judged that no more calcium can be precipitated. Heat until effervescence ceases and simmer carefully to expel carbon dioxide. Remove and wash the cover and filter into a 1000-ml. casserole and wash casserole, paper and residue with twenty 10-ml. portions of hot water. Evaporate the filtrate to dryness and heat gently to remove ammonium salts. Dissolve the residue in 25 ml. of water, add a few drops of ammonium hydroxide, heat to boiling, add ammonium oxalate until in excess (about 5 drops in excess) and let stand over night. Filter through a 5.5 cm. filter into a 75-ml. platinum dish,

wash moderately with a 0.1% solution of ammonium oxalate. Evaporate to dryness, cover the dish and heat at 110 deg. C. Remove the cover, and cautiously ignite until ammonium salts have been volatilized. Cool, dissolve the residue in a little water, filter on a small paper and catch the solution in a small vessel. Wash the paper with small portions of hot water and add a few drops of hydrochloric acid to the filtrate. Transfer the solution to a weighed 75-ml. platinum dish, evaporate the solution to dryness, cover, and heat at 110 deg. C. Ignite at faint dull red heat—not over 500 deg. C., cool in a desiccator, and weigh as NaCl plus KCl. Add 20 ml. of hot water, a drop of hydrochloric acid and 1-2 ml. of perchloric acid, sp. gr. 1.54. Evaporate to dryness at a temperature not over 350 deg. C., cool, add 1 ml. of perchloric acid and repeat the treatment. Cool, add 20 ml. of *absolute* ethyl alcohol containing 0.2% of perchloric acid, sp. gr. 1.54 Break up the residue, let stand 15 minutes, and filter the clear solution through a tared Gooch crucible. Wash the container and residue once or twice with absolute ethyl alcohol containing 0.2% of perchloric acid. Suck dry as possible and dissolve the residue in water. Add 1 ml. of perchloric acid, dry and extract as before. Filter, transfer the residue to the Gooch crucible (which has been washed once or twice with absolute alcohol to remove the water) by means of not over 100 ml. of absolute ethyl alcohol containing 0.2% of perchloric acid and saturated shortly before use by shaking with crystals of potassium perchlorate for 5-10 minutes at room temperature, letting settle and pouring off the clear solution. Suck dry, heat at 120-130 deg. C., cool, and weigh as $KClO_4$.

30. Calculate the weight of K_2O and multiply by 200 to obtain the percent of K_2O.

31. Calculate the weight of KCl, subtract from the weight of KCl plus NaCl, calculate the weight of Na_2O and multiply by 200 to obtain the percent of Na_2O.

32. Blank determinations must be carried through all steps of the method and proper corrections made for any alkalies found.

DETERMINATION OF IRON

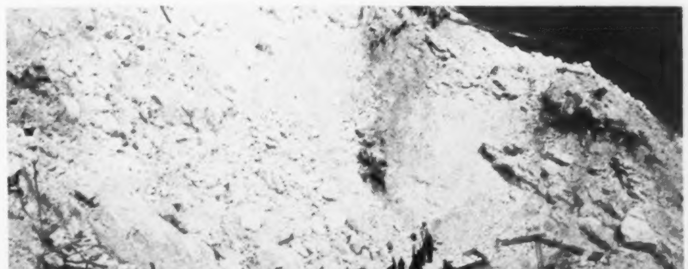
33. Weigh a 10-g. sample of the feldspar to be analyzed using counter balanced watch glasses. Transfer the sample to a platinum evaporating dish of 250-ml. capacity. Moisten the contents of the dish with distilled water and then add 5 ml. of concentrated sulphuric acid. Stir until all of the sample is wet by the liquid. This may be done by rotating the dish. Cautiously add hydrofluoric acid until the dish is two-thirds filled. Spattering of the solution when the HF is added can be avoided by first igniting the sample for a short time. Place the evaporating dish on a sand bath or on a hot plate and evaporate to apparent dryness or until fuming of the sulphuric acid takes place. The last part of the evaporation should be done carefully to avoid spattering. Remove the dish from the hot plate and drive off most of the remaining sulphuric acid over a low flame or in a muffle furnace which is not so hot as to cause loss by spattering. The residue should now be in a dry white cake. When cool, add 25 ml. of dilute hydrochloric acid (1:1) and digest on the hot plate until the residue has been entirely disintegrated. Remove and dilute with hot distilled water. Allow to settle for a few minutes and filter through an 11-cm. paper, catching the filtrate in a 500-ml. beaker. Rinse the dish and filter paper with small portions of hot water. Return the filter paper containing the residue to the platinum dish, dry, burn the filter paper and ignite until the residue is white. Break up the residue with a lump of potassium pyrosulphate and add enough additional pyrosulphate to fuse the residue. This is five to ten times the weight of residue and may be from 15 to 30 g. depending on the weight of the material to be treated. The fusion should be started at a low temperature as some effervescence will nearly always take place. The melt should be kept just liquid by adjustment of the burner flame. When the melt is clear or no particles of the residue remain (30 minutes to 1 hour) remove from the flame and cool. Dissolve the melt by digesting with dilute hydrochloric acid (1:4) on the hot plate. Filter, and catch the filtrate in the same beaker that was used for the first filtration. Ignite the filter paper in a small platinum crucible and if any residue remains fuse it with one gram of anhydrous sodium carbonate until the melt is clear. Dissolve the melt in dilute hydrochloric acid (1:1) and add to the main portion of the solution in the beaker. Neutralize the solution with a dilute solution of sodium hydroxide (20%) and then make slightly acid with dilute sulphuric acid (1:1). Thoroughly saturate the solution with hydrogen sulphide and let stand over night. Filter, and wash the filter thoroughly with warm water. Boil to remove the excess of hydrogen sulphide and to reduce the volume to 100 ml. Add dilute permanganate until the solution turns pink and transfer the solution to a 500-ml. Erlenmeyer flask. Add concentrated hydrochloric acid to the flask until the solution is approximately 1:1 with respect to the acid. Heat the solution to boiling, remove and reduce the hot solution with a minimum number of drops of stannous chloride solution. Adjust the titration head and proceed with the potentiometric titration of the iron, using a standard solution of potassium dichromate.

34. The titration must be corrected for iron contained in the reagents, carrying them through all the manipulations of the procedure. If the analyst is careful to perform all the operations in a standard manner as to time and temperature the blank will be constant.

35. The final volume of the solution should be kept as small as possible in order to obtain sharp end points. In the case of the blank determination, in which the titre should be in the region of two or three ml. of standard solution, the volume of the solution should not greatly exceed 50 ml. With feldspar the volume should be about 200 ml.

36. The concentration of the solution with respect to hydrochloric acid is important as it has an effect on the sensitivity of the end point. The titration must be carried out with speed. This aids in sharp end points and lessens the chance of oxidation of iron by air in the flask.

37. For details concerning the potentiometric titration of iron, see the *J. Am. Cer. Soc.*, **10**, 100 (1927), and **11**, 370 (1928).



Hand loading raw material at the feldspar operation in the McKinney mine, Yancey county, N. C.

New English Cement Plant

A NEW cement plant built at Chinnor, in Oxfordshire, England, by William E. Benton and Son, has some novel features, according to a descriptive article appearing in *Cement, Lime and Gravel* of recent issue.

The plant uses the wet process and has a capacity of 40,000 tons of clinker per year. Chalk and marl ranging from 98% to 42% calcium carbonate are used as a raw material, all of which is disintegrated in wash mills. Apparently no other preliminary grinding is necessary. The cement slurry has a 40% water content leaving the wash mill. It is discharged to a battery of Edgar Allen separators, where coarse particles are removed and returned to the wash mill. Slurry from the separators is of such fineness that 95% passes the 180-mesh sieve. It is then pumped to air-agitated conical bottomed steel storage tanks.

The kiln is 7 ft. 6 in. by 185 ft. and fired by pulverized coal. The inlet is provided with slurry lifters and the last 20 ft. at the discharge acts as a cooler and also is provided with lifters. The kiln is then virtually a combination kiln and cooler with the pulverized coal fuel pipe extending beyond the cooling zone by means of a telescopic pipe. The kiln, coal pulverizers and driers were made by Edgar Allen and Co., Ltd.

The coal drier consists of a double shelled kiln with a combination tube mill following for pulverizing.

Clinker and gypsum are fed by table feeders to a Stag combination tube mill, 6 ft. dia. by 32 ft. 6 in. long. The plant is electrically driven throughout, synchronous motors being used for low-speed drives and induction motors for others.

The company manufactures a high early strength cement under the name of "Chinnorcrete," which on test has shown the following: Fineness, 0.2% retained on 76-mesh sieve; 1.6% retained on 176-mesh sieve; initial set, 1 hr. 15 min.; final set, 2 hr. 10 min.; tensile strength (1:3 mortar), 1-day, 482 lb./in.^{2}; 3-day, 637 lb./in.^{2}; 7-day, 670 lb./in.^{2}; 28-day, 713 lb./in.^{2}

The New Tariff and Rock Products

THE NEW TARIFF law contains the following schedules for various rock products:

Par. 20. **Chalk or whiting** or Paris white: Dry, ground, or bolted, four-tenths of 1 cent per lb.; precipitated, 25% ad valorem; ground in oil (putty), three-fourths of 1 cent per lb.; put up in the form of cubes, blocks, sticks, or disks, or otherwise, including tailors', billiard, red, and manufactures of chalk not specially provided for, 25% ad valorem.

Par. 49. **Magnesium: Carbonate,** precipitated, 1½ cents per lb.; manufactures of carbonate of magnesia, 2 cents per lb.; chloride, anhydrous, 1 cent per lb.; chloride, not specially provided for, five-eighths of 1 cent per lb.; sulphate or Epsom salts, three-fourths of 1 cent per lb.; oxide or calcined magnesia, 7 cents per lb.

Par. 67. **Barytes** ore, crude or unmanufactured, $4 per ton; ground or otherwise manufactured, $7.50 per ton; precipitated barium sulphate or blanc fixe, 1¼ cents per lb.

Par. 73. **Ochers,** siennas and umbers, crude or not ground, one-eighth of 1 cent per lb.; washed or ground, three-eighths of 1 cent per lb.; iron-oxide and iron-hydroxide pigments not specially provided for, 20% ad valorem.

Par. 74 **Satin white** and precipitated calcium sulphate, one-half of 1 cent per lb.

Par. 85. **Strontium: Carbonate,** precipitated, nitrate and oxide, 25% ad valorem.

Par. 201. (a) Bath **brick,** chrome brick, and fire brick, not specially provided for, 25% ad valorem; magnesite brick, three-fourths of 1 cent per lb. and 10% ad valorem.

(b) All other **brick,** not specially provided for: Not glazed, enameled, painted, vitrified, ornamented or decorated in any manner, $1.25 per thousand; if glazed, enameled, painted, vitrified, ornamented, or decorated in any manner, 5% ad valorem, but not less than $1.50 per thousand.

Par. 203. **Limestone** (not suitable for use as monumental or building stone), crude, or crushed but not pulverized, 5 cents per 100 lb.; **lime,** not specially provided for, 10 cents per 100 lb., including the weight of the container; **hydrated lime,** 12 cents per 100 lb., including the weight of the container.

Par. 204. **Crude magnesite,** fifteen thirty-seconds of 1 cent per lb.; caustic calcined magnesite, fifteen-sixteenths of 1 cent per lb.; dead burned and grain magnesite, and periclase, not suitable for manufacture into oxychloride cements, twenty-three fortieths of 1 cent per lb.

Par. 205. (a) **Plaster rock or gypsum,** ground or calcined, $1.40 per ton.

(b) Roman, **Portland** and other hydraulic **cement or cement clinker,** 6 cents per 100 lb., including the weight of the container; white nonstaining portland cement, 8 cents per 100 lb., including the weight of the container.

(c) **Keene's cement,** and other cement of which gypsum is the component material of chief value: Valued at $14 per ton or less, $3.50 per ton; valued above $14 and not above $20 per ton, $5 per ton; valued above $20 and not above $40 per ton, $10 per ton; valued above $40 per ton, $14 per ton.

(d) **Other cement,** not specially provided for, 20% ad valorem.

Par. 206. **Pumice stone,** unmanufactured, valued at $15 or less per ton, one-tenth of 1 cent per lb.; valued at more than $15 per ton, one-fourth of 1 cent per lb.; wholly or partly manufactured, three-fourths of 1 cent per lb.; manufactures of pumice stone, or of which pumice stone is the component material of chief value, not specially provided for, 35% ad valorem.

Par. 207. Clays or earths, unwrought and unmanufactured, including common blue clay and Gross-Almerode glass pot clay, not specially provided for, $1 per ton; wrought or manufactured, not specially provided for, $2 per ton; **bentonite,** unwrought and unmanufactured, $1.50 per ton; wrought or manufactured, $3.25 per ton; china clay or kaolin, $2.50 per ton; **crude feldspar,** $1 per ton; **bauxite,** crude, not refined or otherwise advanced in condition in any manner, $1 per ton; **fuller's earth,** unwrought or unmanufactured, $1.50 per ton; wrought or manufactured, $3.25 per ton; clays or earths artificially activated with acid or other material, one-fourth of 1 cent per lb. and 30% ad valorem; **silica, crude,** not specially provided for, $3.50 per ton; **fluorspar,** containing more than 97% of calcium fluoride, $5.60 per ton; containing not more than 97% calcium fluoride, $8.40 per ton; sand, containing 95% or more of silica and not more than six-tenths of 1% of oxide of iron and suitable for use in the manufacture of glass, $2 per ton.

Par. 208. (a) **Mica, unmanufactured;** valued at not above 15 cents per lb., 4 cents per lb.; valued at above 15 cents per lb., 4 cents per lb. and 25% ad valorem.

(b) **Mica,** cut or stamped to dimensions, shape or form, 40% ad valorem.

(c) **Mica films** and splittings, not cut or stamped to dimensions: Not above twelve ten-thousandths of an inch in thickness, 25% ad valorem; over twelve ten-thousandths of an inch in thickness, 40% ad valorem.

(d) **Mica films** and splittings cut or stamped to dimensions, 45% ad valorem.

(e) **Mica plates** and built-up mica, and all manufactures of mica, or of which mica is the component material of chief value, by whatever name known, and to whatever use applied, and whether or not named, described or provided for in any other paragraph of this act, 40% ad valorem.

(f) **Untrimmed** phlogopite **mica** from which no rectangular pieces exceeding 2 inches in length or 1 inch in width may be cut, 15% ad valorem.

(g) **Mica waste** and scrap, valued at not more than 5 cents per lb., 25% ad valorem; mica waste and scrap valued at more than 5 cents per lb. shall be classified as mica, unmanufactured.

(h) **Mica, ground** or pulverized, 20% ad valorem.

Par. 209. **Talc,** steatite or soapstone, and French chalk, crude and unground, one-fourth of 1 cent per lb.; ground, washed, powdered or pulverized (except toilet preparations), 35% ad valorem; cut or sawed, or in blanks, crayons, cubes, disks or other forms, 1 cent per lb.; manufactures except toilet preparations), of which talc, steatite or soapstone, or French chalk, is the component material of chief value, wholly or partly finished, and not specially provided for, if not decorated, 35% ad valorem; if decorated, 45% ad valorem.

Par. 213. **Graphite** or plumbago, crude or refined: Amorphous, 10% ad valorem; crystalline lump, chip or dust, 30% ad valorem; crystalline flake, 1 65/100 cents per lb. As used in this paragraph, the term "crystalline flake" means graphite or plumbago which occurs disseminated as a relatively thin flake throughout its containing rock, decomposed or not, and which may be or has been separated therefrom by ordinary crushing, pulverizing, screening or mechanical concentration process, such flake being made up of a number of parallel laminae, which may be separated by mechanical means.

Par. 232. (a) **Marble, breccia** and **onyx,** in block, rough or squared only, 65 cents per cu. ft.; marble, breccia and onyx, sawed or dressed, over two inches in thickness, $1 per cu. ft.

(b) Slabs and paving tiles of marble, breccia or onyx: Containing not less than four superficial inches, if not more than one inch in thickness, 8 cents per superficial foot; if more than one inch and not more than one and one-half inches in thickness, 10 cents per superficial foot; if more than one and one-half inches and not more than two inches in thickness, 13 cents per superficial foot; in addition thereto on all the foregoing, if rubbed in whole or in part, 3 cents per superficial foot, or if polished in whole or in part (whether or not rubbed), 6 cents per superficial foot.

(c) **Mosaic cubes** of marble, breccia or onyx, not exceeding two cubic inches in size, if loose, one-fourth of 1 cent per lb. and 20% ad valorem; if attached to paper or other material, 5 cents per superficial foot and 35% ad valorem.

Free List

Par. 1616. **Asbestos,** unmanufactured,

asbestos crudes, fibers, stucco, and sand and refuse containing not more than 15% of foreign matter.

Par. 1645. **Chalk,** crude, not ground, bolted, precipitated or otherwise manufactured.

Par. 1743. **Plaster rock or gypsum,** crude.

Par. 1775. **Stone and sand:** Burrstone in blocks, rough or unmanufactured; quartzite; traprock; rottenstone, tripoli, and sand, crude or manufactured; silica; cliffstone, freestone, granite and sandstone, unmanufactured, and not suitable for use as monumental, paving or building stone; all the foregoing not specially provided for.

New Dimension Stone Quarry Opened in Ohio

THE GLENRIDGE STONE CO., a firm recently organized and made up of Millersburg, Akron and Cleveland, Ohio, interests and which has opened a stone quarry on the Scott and Hipp farm near Glenmont, Ohio, will be shipping stone from the quarry within sixty days provided no unforseen delay is encountered in preliminary work, according to statements made recently by T. J. Schnee, who heads the organization.

Mr. Schnee leased approximately eight and one-half acres of land on the Scott-Hipp farm near Glenmont several months ago. After prospecting and submitting samples of the stone found on the lease, the Glenridge Stone Co. was formed and applications for a railroad switch and power lines were made.

It was stated that workmen are now busy stripping the topsoil in preparation of quarrying the stone. Mr. Schnee stated that as soon as the applications for power and switch had been granted, work would be started on the building of a sawing plant at the foot of the quarry hill. He declared that his firm would saw the stone and ship it in large blocks to cut-stone plants. The stone said to have been found in this quarry is both the variegated and buff.

When commenting on the prospects of business development Mr. Schnee said, "We have a good lease and prospects for a good business."—*Millersburg* (Ohio) *Farmer.*

Bellefonte Ladies Protest Lime Dust

ALLEGING that the lime dust floating over the northern end of Bellefonte, Penn., has become an intolerable nuisance, a committee of women, all residents of east Curtin street, recently appeared before city council and asked that an official protest be made to the American Lime and Stone Co.

Miss Helen Schaeffer acted as spokesman for the committee and was told by council that the sanitary committee would investigate the alleged nuisance and make a report. —*Bellefonte* (Penn.) *Democrat.*

Bethany, Mo., Quarry Gets Highway Stone Contract

ROCK for paving between Eagleville and Lamoni on highway No. 69, where a 9-ft. slab will be made 19 ft. in width, will be supplied from Bethany, Mo.

The contract there was let at Jefferson City recently to the Koss Construction Co. of Des Moines, Ia., which will make an early start on it.

The narrow slab between Bethany and Eagleville will be widened, beginning next spring, and the rock for that also will be taken from the Bethany quarry.

This was the information brought back from Jefferson City by L. W. Hayes, manager of the Concrete Materials Corp. quarry, who went to the state capital to be there when road bids were let, and to obtain information about future work affecting the quarry.

Immediately upon his return, Mr. Hayes began making preparations for running a double shift at the quarry, as it is only by such methods that a sufficient supply of rock can be kept streaming in both directions from Bethany for paving use on No. 69.

Electricians were put at work to connect flood lights to make night work possible, and men applying for work were told to return the first of the week. Thirty-eight men were employed at the quarry the last of the week, and Mr. Hayes said that at least 25 more would be required while the heavy production is continued.

Mr. Hayes gave it as his opinion there are enough men in Bethany and its vicinity seeking work to supply the demand for labor. Hardly a day goes by, he said, that several are not there searching for employment.

He is considering two methods of handling the shifts to increase production to the needed amount. One of these was running two 10-hour shifts, and the other was to run from 4 a. m. until 8 p. m., thus utilizing all the hours of daylight.—*Bethany* (Mo.) *Clipper.*

New Slag Plant for Western Pennsylvania

WORK is progressing on a slag crushing plant which is in course of erection near Baird Station, Penn., by the Cashion Slag Co. of Butler, Penn.

The plant is being erected on property of the American Steel and Wire Co. between the Donora Southern railroad lead to the refuse dump and the Pennsylvania railroad, south of the Donora Southern railroad bridge at Baird Station. The plant will occupy approximately 10 acres of ground and will give employment to about 12 men.

The Robins Conveying Belt Co., of New York, is the general contractor, while the Donora Construction Co. has the contract for foundations and concrete work. A crusher and screening plant will be built, and equipment of the latest and most modern character installed. The plant will be fully equipped electrically, power to be furnished by the West Penn Power Co., which is already arranging to install the necessary transformers to take care of the needs of the new industry.

The steel work on the plant will be done by the Lackawanna Steel Construction Co., Carnegie steel being used in the various buildings to be erected. Machinery for the plant is already being shipped and as soon as the foundations are placed and the necessary buildings in shape the equipment will be installed, with a view to having the plant in operation at the earliest possible moment.

The plant will produce approximately 175,000 tons of crushed blast furnace slag per year, this production being gradually increased until the output will reach the total of 300,000 tons per year.

The slag will be crushed into five different sizes, such as standard ballast, a size that will answer as a substitute for gravel in road work, a size that will answer in the manufacture of concrete blocks and two grades of screening.

The crushed slag produced will either be stocked awaiting shipment, or will be loaded directly into railroad cars for outbound shipment by rail or river. The slag to be loaded into barges for river shipment will be transferred from cars to barges at the foot of the Donora Southern railroad approach to the bridge at Baird.

It is expected to have the plant erected and in operation by the fifteenth of July.—*Monongahela* (Penn.) *Republican.*

New Cement Products Plant for West Virginia

THE newly incorporated Concrete Pipe and Sand Co. of West Virginia, Wheeling, W. Va., has purchased the tract of land formerly occupied by the Thirty-fifth street playground at Thirty-fifth and Water streets, from the Wheeling Steel Corp.

H. L. Seabright is one of the principal incorporators of the new concern. It was learned from a reliable source that Mr. Seabright will probably head the new concern. Negotiations for the purchase have been under way for some time. The immediate construction of buildings or improvement of the property is not contemplated.

According to present plans concrete pipe and other similar materials will be manufactured, but nothing definite has been decided upon.

The property was formerly part of the Wheeling Steel Corp.'s LaBelle Iron Works ground.

The land fronts on the Ohio river and will be accessible for barges. A landing place can easily be constructed. Prominent members of local sand and gravel companies stated they have been expecting the sale of the Thirty-fifth street property to Seabright interests for some time.—*Wheeling* (W. Va.) *Intelligence.*

New Combustible Standard for Cinder Aggregate

By W. D. M. Allan

Manager, Cement Products Bureau, Portland Cement Association

A RECENT REPORT from the Underwriters' Laboratories, Inc., brings the news that the standard for maximum combustible content in cinder aggregate has been raised from 20% to 35% as a result of recent fire tests made at the laboratories.

Manufacturers of cinder-concrete masonry units made under Underwriters' Laboratories inspection service will benefit from this new ruling. The new specification is a result of tests on a panel made of block containing 20, 35 and 45% of combustibles. The block used for the test were made in the research laboratory of the Portland Cement Association, Chicago.

H. M. Robinson, service engineer for the Underwriters' Laboratories, reports that the April 9 fire test has resulted in a recommendation being made to the fire council to revise the concrete block standard to permit the use of cinders containing 35% combustible material. "As we have had no adverse comments from the fire council on the recommended change in the combustible limit," states Mr. Robinson, "the concrete block standard and inspection service procedures for all listed cinder block manufacturers have been revised to include the following requirements which supersede the old specification limiting combustible content to 20% by weight:

" 'When cinders are used, the average combustible content of the mixed fine and coarse aggregate shall not exceed 35% by weight of the dried mixed aggregates.

" 'Note: In general, acceptable results of a single analysis shall suffice to indicate compliance of a specific lot of material with this specification. In case of question as to compliance of material with the requirement, this average shall be determined by analysis of not less than three samples representative of the lot, and in no case shall an individual sample contain more than 10% by weight of combustible material in excess of the specified average.' "

It is understood that this new specification covering cinder-concrete masonry units has been sent out to rating bureaus and is now in effect. This will greatly increase the cinders that will be acceptable for block manufactured under the Underwriters' Laboratories' inspection service, the 20% requirements having acted as a considerable handicap in certain sections of the country.

In his report to the fire council of the Underwriters' Laboratories, J. B. Finnegan, associate engineer of the protection department, made the following recommendation:

"The results of the test warrant the opinion that cinder concrete blocks, containing not more than 35% combustible material in their aggregate, and complying in all other respects with the existing standard, should be considered eligible for listing as standard, with a fire retardant classification of 3-hr. It is the intention of the staff, therefore, to amend the standard and inspection service procedures, to specify a 35% maximum instead of the 20% maximum now in effect, unless otherwise directed by the council within 10 days."

Tulsa to Be Site of $2,500,000 Cement Plant

SELECTION of Tulsa, Okla., as a location for the establishment of a $2,500,000 cement plant by the Missouri Portland Cement Co. of St. Louis and Kansas City, was revealed June 10 in an announcement at the weekly meeting of the chamber of commerce board of directors, says the *Tulsa* (Okla.) *Tribune*, which continues:

The announcement was made by Geoff A. Saeger, chemical engineer of the company, and P. H. Blaise, general superintendent over all plants, who were guests of the board.

The company representatives pointed out that the plant will furnish employment for at least 250 men, in addition to salesmen who will work out of Tulsa headquarters. Definite announcement of the plant site will be withheld for the time being until engineers have completed core drilling at possible quarry sites near the city. The engineering work, under the direction of W. R. Holway of Tulsa, began today.

It was estimated that at least nine months will be required to place the plant in operation. It will be constructed along the most modern lines, the officials said, with kilns 340 ft. in length. The Tulsa kiln will be the largest in the country, they said. The wet process of manufacture will be used. They explained that this is the most modern process yet devised and serves to eliminate the dust which formerly was so much in evidence under the old process.

The decision to establish the plant at Tulsa was reached following a comprehensive survey by company representatives of the raw material available, market conditions and other factors making for the success of such an enterprise. All factors were found to be extremely favorable, Mr. Blaise said.

Tulsa first came to the attention of the company in connection with the visit here several months ago of Hiram Norcross, vice-president and general manager, in company with a party of St. Louis business men. Messrs. Saeger and Blaise gave extensive credit to W. G. Skelly and other members of the cement mill committee of the chamber of commerce for finally bringing about the company's decision.

Waite Phillips is chairman of the committee and other members are J. A. Frates, Eldon J. Dick, F. B. Parriott, C. H. Hubbard, A. L. Farmer, William Holden, John G. Mayo, S. E. Wolfe, Walter O'Bannon and W. R. Holway.

The Missouri Portland Cement Co. is recognized as one of the strongest companies of its kind in the field. Two plants are now operated at St. Louis and one at Kansas City. The nearest competition in the eastern Oklahoma field, which the plant here will have, is at Dewey and Ada. The Tulsa plant will have a daily capacity of 3000 bbl., the officials said.

Its establishment here is expected to be followed immediately by the construction of other industrial plants in the same vicinity, which derive their raw material from the cement plant. This has been true in other cities. Such industries as block and sewer pipe plants are dependent on the cement industry for raw material.

Cement will be piped from the Missouri Portland plant to the neighboring industrial units.

Mr. Saeger estimated that the Tulsa plant will require an electric power supply of 1,750,000 kw. a month. The plant will be financed almost in its entirety by the Missouri Portland Cement Co. It is possible that some stock will be placed on the public market, Mr. Saeger said.

It is proposed to change the name of the Tulsa company in a manner to localize the products of the plant here.

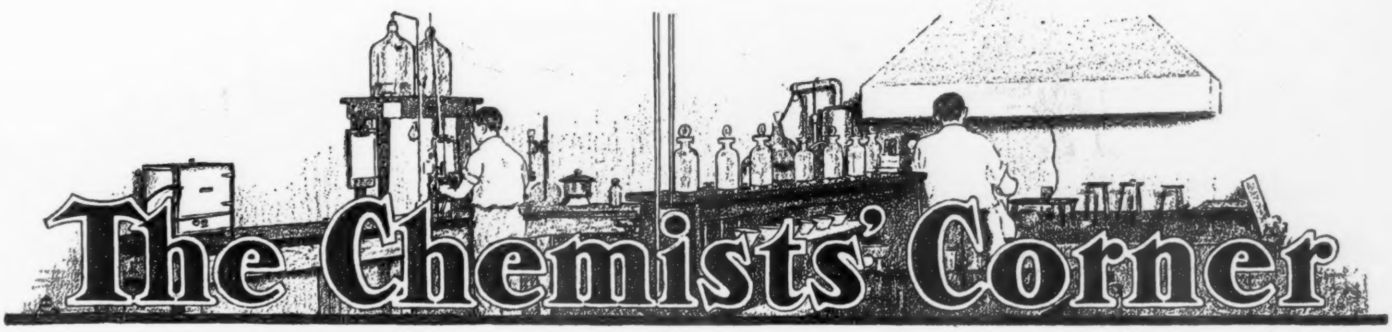
Memphis Gets Ninth Annual Asphalt Paving Conference

AT A MEETING of the board of directors of the Asphalt Institute, held June 3, in New York City, the city of Memphis, Tenn., was selected as the meeting place for the ninth annual asphalt paving conference to be held this year, the meeting to convene on Monday, December 1, continue through December 2, 3, 4 and 5.

The Association of Asphalt Paving Technologists will, as usual, meet in conjunction with the conference.

The arrangement will be in charge of various national and local committees created for the purpose. O. I. Kruger, city commissioner of Memphis, and W. B. Fowler, Memphis city engineer, are assisting in organizing the committees which will have charge of the local arrangements. An elaborate entertainment program is being planned.

From 1000 to 1500 engineers, technologists, public officials, contractors and asphalt producers are expected to be in attendance, since an effort this year will be made to break all previous attendance records.



Standardizing Cement Sieves

By E. Taylor
Cebu Portland Cement Co., Naga, Cebu, P. I.

THE fineness test for portland cement is a comparatively simple operation. Erroneous results, however, are frequently obtained due principally to the following causes.

1. The 200-mesh sieves and wire cloth supplied by manufacturers as "standard" are very often far from being such. The writer has had new sieves and cloth that gave errors of from 1 to 5%. This, of course, does not apply to sieves checked by the Bureau of Standards.

2. The sieves, even though once standardized, are affected by constant use. Usually some of the openings become clogged and the results tend to become lower with use. In plant laboratories where numerous control tests are run daily this often happens with the result that the finish mills are made to grind finer than necessary, with reduced output, and the cement is not uniform.

To overcome these errors, the writer uses the following method of standardizing sieves and keeping them standard until completely worn out.

A 200-mesh sieve checked and standardized by the Bureau of Standards at Washington is kept in the laboratory inside a desiccator.

A large bottle is filled with about 5 lb. of cement, and the fineness of this is determined with the Bureau of Standards sieve.

Each fineness tester of every shift is required to test the fineness of the cement in the bottle with the sieves actually in use in the laboratory, no corrections being applied to the results. The results obtained every shift are entered on a card which is examined every morning by the laboratory chief. The results of the three shifts are averaged and compared with the true fineness of the cement in the bottle and the necessary corrections determined daily for the sieves in use. These corrections are then applied to the sieves until new corrections are ordered.

This system continually insures correct results and has the further advantage that the Bureau of Standards sieve is only used occasionally thus preserving its accuracy.

The form of the record is shown in the table.

SIEVE TESTS—STANDARD CEMENT = 87.4% B.S.

Date	Shift	Operator	F. mill sieve	Correction	Pack house sieve	Correction
4-10-30	1	A. B.	88.9		85.4	
	2	P. G.	88.0		85.8	
	3	M. A.	88.6		86.0	
Average			88.5	−1%	85.7	+2%
4-11-30	1					
	2					
	3					
Average						
4-12-30	1					
	2					
	3					
Average						

Rate of Solution of Very Small Particles

IT IS COMMONLY SUPPOSED that rates of solution are strictly proportional to the surface exposed to the action of the solvent. This statement is true for particles whose diameter is larger than about 20 microns (one micron—1/25,000 of one inch). For anhydrite particles smaller than 20 microns, it has been found by the Nonmetallic Mineral Experiment Station of the United States Bureau of Mines, at Rutgers University, New Brunswick, N. J., that the rate of solution is no longer directly proportional to the surface exposed but increases more rapidly than the specific surface. If the ratio of the rates of solution per unit surface exposed of particles below 20 microns in size to that of particles above 20 microns in size is plotted against the particle size, the curve thus obtained reaches a maximum at 1.5 microns where this ratio was 17, i. e., the rate of solution was 17 times greater than would be predicted from the proportionate increase in surface. This increased rate of solution may, in the case of the smaller sizes (below 2 microns), be partly due to the somewhat higher solubility of the smaller particle, but in the range from 20 to 2 microns there is very little, if any, variation in the concentration of the saturated solution, and hence the increased rate of solution must be due to some other factor.

Portland Cement Mixtures

THE Portland Cement Association and the Bureau of Standards, Department of Commerce, Washington, D. C., have published a paper by W. C. Hansen on the "Influence of Magnesia, Ferric Oxide and Soda upon the Temperature of Liquid Formation in Certain Portland Cement Mixtures."

The paper gives the results of a study of the influence of ferric oxide, magnesia and soda upon the temperature at which melting starts when they are added individually and collectively to mixtures of lime, alumina and silica, corresponding to portland cement mixtures.

It was found that these mixtures of lime, alumina and silica started to melt at 1455 deg. C., and that the temperatures at which melting started were reduced when one or more of the other oxides had been added. The greatest effect was noted when all three, ferric oxide, magnesia and soda, had been added, in which case the temperature at which melting started was 1280 deg. C. Other melting temperatures between these two were observed with the addition of one or two of the oxides.

Microscopic and X-ray studies were made to determine the compounds at equilibrium.

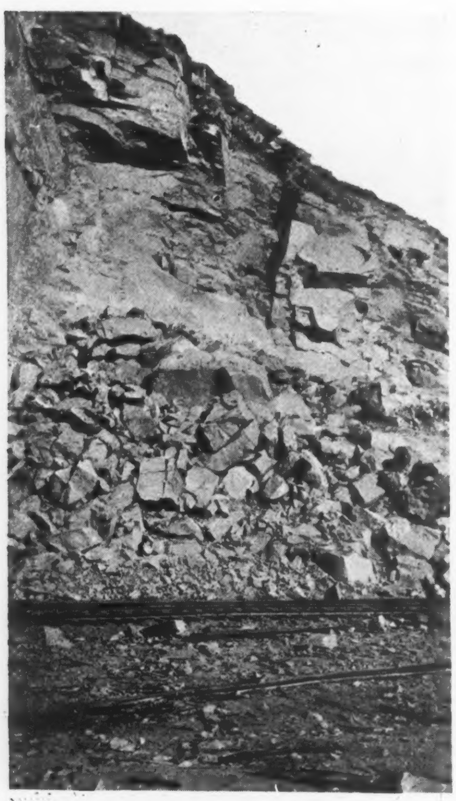
Reprints of this paper may be obtained upon application to R. H. Bogue, Research Director, Portland Cement Association Fellowship, Bureau of Standards, Washington, D. C. Ask for No. 22.

Hints and Helps for Superintendents

Blasting Method for Minimum of Fines

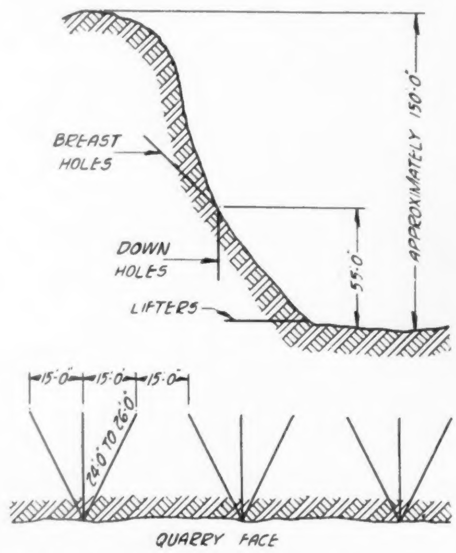
THE HAUSER CONSTRUCTION CO. operates a quarry near Riverside, Calif., for the purpose of supplying rip-rap for harbor construction at Long Beach and elsewhere on the southern California coast. No commercial crushed stone is produced, so that the operating problem is chiefly one of quarrying, so as to promote maximum economy in powder consumption and a minimum of fines—pieces less than 25-lb. weight—which are wasted. The problem has been solved by the use of black powder and a special arrangement of drill holes, so that scarcely any fines are produced.

The original method of shooting in this quarry was by the use of coyote holes, but this procedure not only produced an excessive amount of small stone but was costly. Powder requirements by this method approximated ¾ ton of stone per pound of explosive, while with present practice 4 tons of large stone per pound of explosive is ordinary experience—and in one of the recent shots fired 40,000 tons of ideal rip-rap material was brought down with 134 cases of powder—a figure which includes 24 cases of dynamite used for springing the holes. This shot had a powder consumption of 5.97 tons per pound of explosive.



Showing fine material produced by old coyote method

In the above shot, a total of 46 drill holes, having a depth of 24 to 26 ft., were put in, 14 horizontal holes or lifters, 14 down holes, with 18 breast holes. These holes were all drilled so as to take advantage of any natural slips or cracks in the formation, but when feasible three holes were all drilled from one set-up and fanning out at the back to about 15-ft. centers, with the three holes all being in the same plane. The sketch shows the approximate location of the lifters, down and breast holes with respect to a cross-sectional view of the quarry face.



Showing location of lifters, down and breast holes with respect to cross-sectional view of quarry face

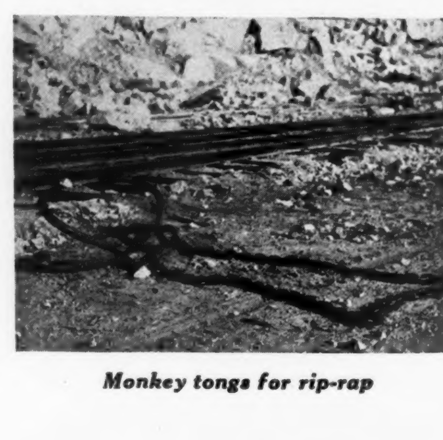
The holes started at 3 in. with a $\frac{1}{16}$-in. drop in gage for every 2 ft. change of steel, and after springing, to enlarge the powder pocket, with 80% Hercules dynamite, were loaded with free-running IXL Giant bag powder. The powder is blown into the holes by means of an air gun which consists of a brass tube at one end of which is mounted a funnel, into which the powder is poured. The funnel is so constructed that the powder is jetted into the holes by compressed air. Stemming on the down holes was with rock dust, and for the lifters and breast holes rock dust enclosed in paper cartridges was used. The shots were electrically exploded.

Most of the stone shot down from this shot ranged in size from a few tons up to several hundred tons, with practically no stone weighing less than 100 lb. Another interesting feature of this operation is that practically all block-hole blasting is done with black powder as the explosive.

Massive chunks are produced with black powder shot

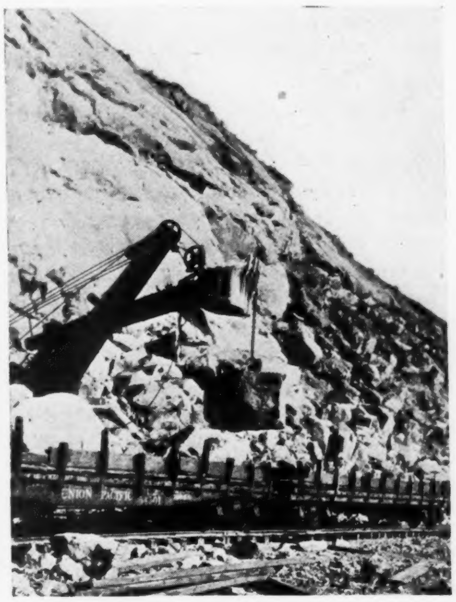
"Monkey" Hooks

FOR LOADING RIP-RAP, the Hauser Construction Co., at Riverside, Calif., has two 50-B Bucyrus shovels with a 1¾-yd., American Manganese Steel Co.'s Vanderhoeff bucket. Chain slings are used for most



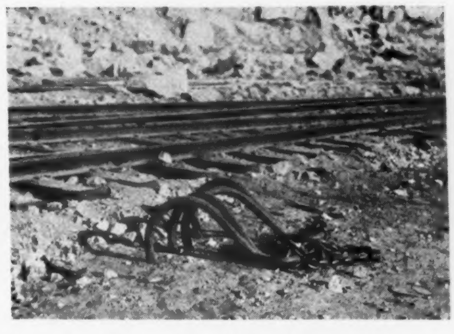
Monkey tongs for rip-rap

of the 5- to 15-ton pieces of rip-rap, but an ingenious device known as a "monkey" hook is also used for handling stone to the cars. This consists of a heavy chain which passes through the eye of two hooks, forming an enclosed loop. The chain loop is thrown over the tooth of a shovel and the monkey hooks dropped over the stone, and when the lifting pull is put on, owing to the design of the tongs, the hooks close on the rock.



Shovel loading rip-rap with chain sling

An idea as to the shape of these tongs can be obtained from the illustrations, and it was emphasized by the users that for proper functioning of the tongs considerable experimenting was necessary to obtain by experience the proper length and shape of the tines. The tongs were fabricated from 1¾-in. octagon steel.

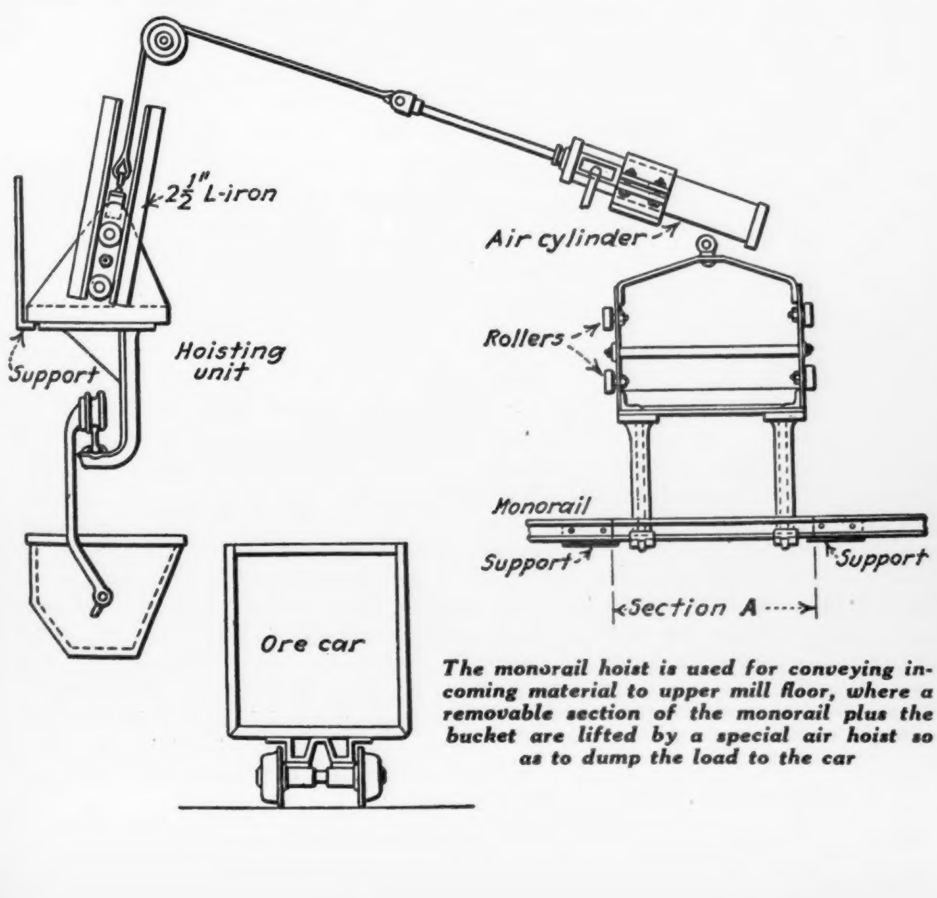


Another view of monkey tongs showing their construction

Monorail Hoist

AT the Park Utah Consolidated Mining Co., the ore, concentrate, coal, and coke are transported by a rope tramway from mill terminal to railway depot and vice versa, according to the *Engineering and Mining Journal*. To convey incoming material to the upper mill floor and tunnel level, the tramway, through a switch, is directly connected to a light monorail system, which enables the operator to place the cable carriage as closely as possible to the mill elevator. Difficulties, however, were experienced in transferring coal or coke to the aforementioned points, as the monorail is installed at an elevation too low to permit direct dumping of the bucket contents into ore cars. The coal first had to be emptied on the floor, then shoveled by hand into cars.

To avoid this labor, a cylinder, operated by compressed air, a pulley, and a hoisting carriage were constructed and installed, as shown in the accompanying sketch. The hoisting carriage, made of angle iron and ⅜-in. sheet iron, has two bolted-on monorail bracket supports, with a 3-ft. section of the monorail and two steel rollers, bolted on each side. Four 2½-in. angle irons act as guides for the carriage, and two supports, bolted on each end of the monorail, assure a perfect alignment of the inserted section *A*. The operation is simple. The cable carriage, with attached loaded bucket, is placed on section *A*, and raised by the air cylinder to permit direct dumping of the bucket's contents into the ore car.



The monorail hoist is used for conveying incoming material to upper mill floor, where a removable section of the monorail plus the bucket are lifted by a special air hoist so as to dump the load to the car

Safety First!

SAND AND GRAVEL PRODUCERS often complain that their industrial insurance rates are unreasonably high. No doubt that if more statistics of reputable producers were available to show the hazards, a better rate could be obtained.

One practice that we believe is quite common in the sand and gravel industry is that of riding conveyor belts. It should be universally stopped. The accompanying illustration shows the second time within the past four months that an editor of this publication has caught with his camera an employe riding the belt. Likewise, we might remind the owners that it's hard on the belt.

Employe snapped riding conveyor belt

Chamber of Commerce Members Inspect New Diamond Springs Lime Co. Plant

BUSINESS MEN of Placerville, Calif., and members of the El Dorado County Chamber of Commerce recently visited the million-dollar plant of the Diamond Springs Lime Co. and heard details of the operations which have resulted in placing El Dorado county lime on the markets of the world. About 25 were on the tour, and were guided through the plant by Homer P. Brown, president and general manager of the company, and the chemical engineer, R. W. Rothrock.

Arriving at the plant the local delegation was met by the officials of the company and conducted through the modern laboratory. In this well equipped laboratory tests are constantly under way to determine grades and qualities of the raw limestone as it comes from the quarry and tests are carried on to determine proper mixtures for the various products of the plant. A number of sample tests were made by chemists for the benefit of the visitors.

From the laboratory, the party proceeded to the unloading platform at the upper end of the plant, where a tramway brings the raw rock from the quarry three miles away. Buckets, each containing about 800 lb., are spaced on the cable to arrive at the unloading platform every 45 seconds, the president explained, in that way an 8-hour shift at the quarry supplying sufficient rock for almost a 24-hour run of the kilns.

A number of fruit experts and growers in the party were especially interested in a huge pile of agricultural, or fertilizer, lime piled outside, and the chemists explained that that lime was a byproduct of the kilns, and that a huge amount of it was consumed every year by agriculturists.

The details of the processes through which the lime is put were explained to visitors as they proceeded from the unloading platform down through the plant. Three piles of limestone rock under the bins which have a capacity of 110 tons were explained to be different in quality and specially trained workmen are engaged to select the proper mixtures of each for the various kinds of lime desired. A huge shovel, especially designed for the plant, is installed at this point and rapidly and economically transports the quantity desired to the elevators and unloading devices which start the raw material on its way through the kilns.

Crushing of the rock, it was explained to the visitors, is done by two crushers, one at the quarry, where the rock is reduced to about a 7-in. size, and the other at the unloading platform, where it is crushed to a maximum of 2¼ in.

Processed lime, Mr. Rothrock explained, has been known and experimented with for many years, and a processed lime was marketed in the east as far back as 1922. A satisfactory processed product, however, had not been developed until the local plant began to market it in its present form. The system in use, although a secret, does not make use of chemicals or other artificial treatments, the chemist stated, but lies wholly in the method of mixing, the manner of burning and the general treatment of the raw material to bring the desired qualities out in the finished product.

Only one kiln is installed at present. It is of the latest and most approved design, it was pointed out, and offers tremendous advantages over the old style vertical kilns used in years gone by.

An original feeder designed by engineers of the local company is used to feed the raw rock into the head end of the kiln. The feeder is synchronized with the mechanism which turns the kiln, thereby insuring an even level of rock passing through at all times and making it possible to regulate the speed of burning and feeding by one simple adjustment.

The temperature of the kilns at the head end is approximately 1300 deg. F., the guests were told, while at the lower, or delivery end, it is maintained at about 2000 deg., occasionally being as low as 1800 deg. or as high as 2200 deg., according to the kind of lime product desired to result.

Fires in the kiln are controlled electrically as to regulation, and the burners are so designed that the flame is never directly upon the rock passing through, but upon the walls of the kiln itself, thereby preventing any possibility of burning the product too much.

Dropping into a hopper almost white hot when it reaches the end of the kiln, the lime is carried through a cooler similar in design and rotation to the kiln itself, but operated at a slower rate of speed, and equipped with flanges inside which keep the rock in motion to insure even cooling. The cooler's contents are fed to specially designed conveyors, which take the lime to storage bins to await pulverizing and the process which will render it ready for market, either as hydrated lime or in the processed form, which has been responsible for the widespread recognition accorded the Diamond Springs company product.

The huge storage rooms of the plant, capable of holding hundreds of tons of all kinds of lime products, were inspected by the visitors, after which a practical demonstration was made of the slacking of processed lime. Twenty-two gallons of water were used for one bag of 60 lb.; and the lime had been slacked and was in workable putty form within 10 minutes. A chemical change in the lime results in turning it from brown to pure white during slacking, and the officials pointed out that the lime has a natural tendency to set after application. Constant tests are conducted with products from other lime plants, as well as their own, the officers stated, and the local product has proved superior to anything yet found.

In this connection it was stated by workmen participating in the slacking demonstration that one man could easily slack 60 bbl. of the processed lime in one day, while a good hard day's work with other types of lime would result in not more than 30 bbl.

The party, after inspecting the blacksmith shop and other buildings and being told of general details which are involved in the manufacture of the newest El Dorado county industrial plant, returned to Placerville, well satisfied with the manner in which the afternoon had been spent and with a bigger and better understanding of the significance of the plant.

To date the investment in the industry at Diamond is in excess of $900,000, and completion of the other kiln and necessary equipment will round out the million-dollar program scheduled since the plant was started, nearly three years ago. In addition to that investment, more than half a million dollars has been spent in payroll since the company began operations—98% of which has gone to El Dorado county people, no outside help having been brought in except Mr. Rothrock and one or two highly trained specialists to assist in the proper training of local workmen for various functions of the plant.

The trip was one of a series which is planned by the local chamber of commerce, including the annual good will tour to Lake Tahoe, which will be made in the near futurs.—*Placerville* (Calif.) *Republican.*

Hoosac Valley Lime Co. Wins Government Contract Case

CONGRESSMAN ALLEN T. TREADWAY, always painstaking in his use of words, has just won an important decision assuring the award of a large government contract to the Hoosac Valley Lime Co., Adams, Mass., through arguing the importance of two omitted words in specifications for a new government building.

The building is the projected commerce department structure to cost $17,500,000, and which is to be the largest office building in the world. Original specifications called for the use of "hydrated or powdered lime" in the masonry. In the contract given the Hoosac Valley company the lime was specified merely as "hydrated." Immediately an Ohio firm contested the award, saying it also produced this form of lime and should get a part of the contract.

Congressman Treadway went before officials of the supervising architect's office and his argument that the omission of the words "or powdered" was of vital importance and an injustice to the Adams firm, was accepted. Finally the joint treasury and post-office department building committee which has the responsibility for all new government buildings, decided that the omission of the words was plainly an oversight and that the Adams company should be allowed to complete its contract.—*Pittsfield* (Mass.) *Eagle.*

Editorial Comment

The New Tariff

So far as we know, ROCK PRODUCTS is the only journal interested in the portland cement industry that has had the courage to come out openly, persistently and consistently for a tariff on cement. We are aware that the new tariff law has been, is, and will be, unpopular with many people. And our own efforts in behalf of a cement tariff were not popular in Belgium, and other foreign countries where ROCK PRODUCTS has many subscribers and readers in the cement and allied industries. They were not popular with some elements in our own country which are interested in importing cement or clinker. We stood out for a cement tariff because we believed it right.

There are doubtless many bad features in the new tariff law, but the power given in it to the Federal Tariff Commission and the President to make adjustments should help. While the portland cement industry did not get all it asked for, or all that the Tariff Commission recommended it should have, we are glad it got some protection; and we hope it will get more in any readjustment. Its case suffered because it became a controversial item—for no other apparent reason than that portland cement has been so widely advertised and popularized that it made a valuable "trading commodity" for local-minded politicians.

It is questionable, of course, whether or not the rather unfavorable publicity the cement industry has had in connection with the tariff has done it about as much harm as the tariff itself will do it good. But we doubt that any real harm has been done. The portland cement industry never has been popular for the simple and easily explainable fact that cement price quotations on public work are generally uniform. Local politicians inevitably seize on this fact for political capital. A good example of this is the recent reported purchase of Belgian cement by the state highway department of South Carolina, which we have commented on in the following editorial.

It is quite likely that the quick enactment of the new tariff law will change the plans of the South Carolina officials, who are now reported to be promoting a plan to build a new plant in South Carolina. In any event the attitude displayed by the chairman of the state highway commission, in what follows, is typical of the attitude of numerous public officials, and is responsible in a very large measure for the unpopularity of the cement industry.

South Carolina's Imported Cement

A news item, based on local newspaper articles, in ROCK PRODUCTS, June 7, stated that the highway department of South Carolina had contracted for 1,000,000 bbl. of Belgian portland cement at $2.40 per bbl., f. o. b. Columbia. The *Manufacturers Record,* Baltimore, Md., wrote to the governor of South Carolina in protest, and received an answer from the chairman of the state highway commission. This letter and the *Manufacturers Record's* comments are published in its June 12 issue. The letter of Chairman Jones of the South Carolina state highway commission propounds some questions that the *Manufacturers Record* does not attempt to answer, dismissing them, rather lamely it seems to us, by merely "deploring the attitude which prompts some Americans to take a step of this kind."

We ought to do more than *deplore* such attitudes or *acts of public officials;* and it seems to us that the questions which Chairman Jones proposes are not at all hard to answer by anyone with some knowledge of business principles, a little comprehension of the nature of the portland cement industry, and a slight appreciation of fairness and a desire to render genuine public service.

Mr. Jones is quoted as having written: "The nine American cement manufacturers bidding quoted prices identical with prices freely quoted to dealers in South Carolina in single car lots of only 200 bbl. Based on shipment from Birmingham, Ala., cement delivered at Charleston would yield the mill a net return of 87 cents per bbl.; delivered at Columbia, $1.34 per bbl.; delivered at Spartanburg, $1.50 per bbl."

The questions Chairman Jones proposes we will take up one by one—and give answers that, to our own satisfaction, at least, are entirely adequate:

Mr. Jones: *"Can you justify their attempt to charge the State of South Carolina a higher price at the mill for cement that is going to be delivered at Spartanburg than for identically the same cement delivered at Charleston or Columbia?"*

Answer: Certainly. How else can competition in a widely distributed staple commodity be conducted in an extensive territory by a group of producers with a different freight rate from every one of the several competing mills to every one of the various points of delivery? It is impossible to have a standard basic mill price without at the same time confining the market territory of each mill within a specific territory bounded by a limiting freight rate. If this were done, and the mills geographically distributed accordingly, each mill would have an absolute monopoly in its own particular territory, with its highest price closest to the mill, and be compelled to operate spasmodically whenever there happened to be business in that territory. Of course, such a scheme of doing business is unthinkable to a modern industry in a modern country served by a network of transportation lines—and would not be desirable either to the consumer or to the producer. This whole question has been threshed out so thoroughly and so many times, and has been explained so convincingly by economists and to and by courts of law that the man who does not comprehend or appreciate it is plainly and simply ignorant of the fundamental principles of the business of production and distribution.

(Continued on next page)

Mr. Jones: *"Can you justify their attempt to charge the State for 1,000,000 or more barrels of cement at identically the same price per barrel quoted to dealers in South Carolina in only carload lots?"*

Answer: Yes. If prices in South Carolina and other parts of the South are already at rock bottom, and anyone who will make the least inquiry can determine that they are, there certainly is no justification, business sense, moral, or otherwise, for making yet lower prices to *anyone*. As a general proposition, whether cement manufacturers should ever undersell dealers or not, there are differences of opinion in the cement industry itself; but since the dealers are steady customers year in and year out, while the state is a spasmodic one, we can't see why the dealer is not entitled to as low a price as anyone. Mr. Jones should certainly be interested in seeing citizens of his own state treated fairly, even if they are building-supply dealers.

Mr. Jones: *"Can you defend their identical price structure, calling for identical prices at each delivery point in South Carolina, and truthfully say there is no combination or understanding amongst them?"*

Answer: Absolutely yes. The price structure of the portland cement industry is the outgrowth of many years of the keenest competition, which establishes a delivered price based on the price made by the nearest, or most favorably located mill to the point of delivery. These prices are matters of common knowledge to both producers and consumers. Naturally, unless the competing mills less favorably located met this price they wouldn't get any business there. Under sane conditions they would not cut the price, because if they did, the competing mills would cut prices in that mill's more favorably located territories, and the net result would be that all net mill prices would be lowered to a point where there would be no profit in any mill's business. Such conditions actually exist in the portland cement industry in this very territory today. Again, let us refer Mr. Jones to the well-known and famous decision of the United States Supreme Court in the portland cement and maple hardwood flooring industries' cases, where the inevitableness of such a price structure is fully explained.

Mr. Jones: *"Should South Carolina be forced in your opinion to purchase cement in large quantities at the same price the ordinary customer pays in small quantities, when the large State purchase involves no sales costs and no credit risk whatever to the cement industry, and when it is admitted by the cement producers that more than 10 cents per barrel is required to cover sales costs?"*

Answer: If the price asked is the lowest commensurate with a fair profit, yes. The state would get 1,000,000 bbl. at the rock bottom price of today, and unquestionably the price to dealers will shortly have to be raised, if the mills are to survive. We don't see why, under the circumstances, the general question of manufacturer-dealer relationships need be answered or considered further.

Mr. Jones: *"In your opinion, is the stabilizing effect of large orders, to be delivered over relatively long periods, worth nothing to the American cement industry?"*

Answer: If the present and prospective business were on a profitable basis, yes. But, as happens to be the case, since present business is being taken at a loss, where would the cement industry be the gainer by taking a larger volume of business at a greater loss? "A million times nothing is still nothing." If Southern cement manufacturers are sane and expect to remain in business, it is certain they do not expect present prices to prevail "over relatively long periods."

Mr. Jones: *"In your opinion, should South Carolina be called on to submit meekly and without a struggle to the united purpose on the part of the American cement industry to make her contribute heavily toward the liquidation of losses the American mills have sustained in the preceding years?"*

Answer: If you want to put it that way, yes. Somebody, some time, and that means the public of South Carolina and its neighboring states, has got to make good the losses of the portland cement industry in the South, and of every other industry that has losses, if those industries are going to survive and continue to do business in the South. People do not go into industry or business for their health or for recreation. Obviously, as the merest novice in business knows, the losses of one period must be made up by the profits of another, or the business or the industry simply ceases to be. And the accomplishment or working out of this economic truism does not require or imply collusion or united action on the part of the depressed industry. Is Mr. Jones so simple-minded that he believes because there happens to be no cement industry in his own state that the people of South Carolina don't suffer from its losses? We doubt it. The prosperity of South Carolina is just as much dependent on the prosperity of its neighbors on the other side of imaginary boundary lines as it is dependent on the business within those lines. South Carolina raises cotton to make cement sacks, it raises or produces other things to supply the wants and needs of American men and women dependent on wages and profits of the cement industry for subsistence. When an industry loses money who loses it? Maybe Mr. Jones thinks it's only the stockholders. But how about the loss in wages, the loss to communities through want of employment and resultant emigration, the loss in taxes to the commonwealth, etc., etc.? One doesn't have to be a protectionist to know that the public eventually pays the bill of unsuccessful business enterprises—and pays with interest many times over. And the people of South Carolina are no exception.

In justification of his Belgian cement purchase Mr. Jones is quoted as writing the *Manufacturers Record:*

"The bid on foreign cement was exactly 13 cents per barrel less than the identical price quoted by the nine American cement mills which when applied to the 1,000,000-bbl. purchase represents a saving of $130,000. Personally and officially, we prefer American-made goods, but do not believe our preference should be indulged in at the expense of the taxpayers of South Carolina.

"Should American mills quote prices to meet existing foreign competition, their price for South Carolina delivery points would net the mills, basis Birmingham, $1.25 per bbl., which is 25 cents per bbl. more than the mills were quoting last fall, when there has been no change in prices of labor or other factors making up their per

barrel costs. One dollar and twenty-five cents, net, per barrel basis, Birmingham, will show any mill a reasonable profit and is far above the average per barrel price of orders now on the books of a number of the mills and awaiting shipment."

Now, it seems the $2.40 per bbl. price on Belgian cement is the f. o. b. Columbia price; and the $2.53 per bbl. price on domestic cement with which Mr. Jones compares it, is also the f. o. b. Columbia price. Charleston is the port of entry for the Belgian cement, and Columbia is something like 100 miles distant, while the nearest domestic mill to Columbia is at least 150 miles distant, and Columbia, being near the geographical center of the state and the mills all in neighboring states, it is naturally about the most expensive point for the domestic mills to reach. The $2.40 price on imported cement, it is announced, will have to be "adjusted according to freight rates," for other interior points of consumption. In other words, from all the evidence yet made public the alleged saving of $130,000 is a pure fiction, for when the actual cost of the imported Belgian cement at interior points more accessible than Columbia for domestic shipments is compared with the actual cost of domestic cement at those same interior points, it is our guess, without any particular knowledge of the freight-rate structure, that Mr. Jones won't be able to show a total saving of 13 cents.

The last paragraph of Mr. Jones' quotation is ambiguous, since earlier in the same communication he stated that the delivered prices on domestic cement netted the mills from 87 cents to $1.50 per bbl. If this is true the average net mill price must be in the neighborhood of $1.25 per bbl., or even less. If the Southern mills can make a living profit on this mill price they are good. Few mills in other parts of the country could. If, as Mr. Jones says, a net mill price of $1.25 "is far above" the net mill price of much of the business now on the books of domestic manufacturers, it seems to us that this is all the more reason why a customer who knows the present hazardous condition of the industry in the South and has some regard for its survival should be willing to pay the asking price. If Mr. Jones interprets the will of the people of South Carolina as desiring to wreck the Southern cement industry, or as asking for cement at prices profitless to Southern mills, we believe he is wrong, or else the people of South Carolina are less enlightened and more lacking in common, ordinary business sense than people of other localities.

And now we would like to end our discussion with a suggestion to the cement industry and any other industry that finds itself in a similar situation. Don't let Mr. Chairman Jones get away with this! Apparently it is a grandstand play to the public, or perhaps a real lack of understanding of the economics of the case. Get a reliable accountant to check up on Mr. Jones' alleged saving of $130,000. Get the specific facts in regard to just what the loss of this 1,000,000-bbl. order means to neighboring Southern communities and to the people of South Carolina, directly and indirectly. And spread these facts before the people of South Carolina in page advertisements in local newspapers—if you can't get them before the public in the news columns. It would be a mighty good investment—and a genuine public service.

Colorado Flux-Stone Quarry to Be Developed

THE Colorado Fuel and Iron Co. of Pueblo has purchased the Warren Burton lime quarry at Monarch, near Salida, Colo., for $50,000. It is thought that $200,000 worth of new machinery will be installed shortly. Twenty cars of ore are shipped daily at present, but it is thought that the output will be increased to 40 by the end of the summer.

An all electric 2-cu. yd. shovel will be a part of the new equipment, it is reported.

A new manager will be put in charge of the plant, replacing Mr. Burton, who purchased the quarry from C. W. Archer of Philadelphia five years ago. Mr. Burton has not announced his plans for the future.

The C. F. and I. plant formerly got its lime from Calcite, near here. The company closed the quarries there recently but it is rumored here that a sugar company is to take over the quarry in the near future. The Monarch quarry is said to have enough stone to last for about 20 years.

Twenty men are now employed at the quarry. It is thought that the usual mining output will continue during the time of installing the new machinery. It is not thought that additional men will be added when the new machinery is installed, as it is believed that the same crew with newer machinery can increase the output to about 1000 tons a day.—*Pueblo* (Colo.) *Star-Journal.*

Aetna Portland Cement Building New Silos

PREPARATIONS are being made for the erection of four new silos which will practically double the storage facilities of the Bay City plant of the Aetna Portland Cement Co., Bay City, Mich., it was announced recently by Edward A. Harris, office manager. The approximate expenditure will be $75,000.

The general contract for the work has been awarded to the Macdonald Engineering Co., Chicago. The contractors are now at work driving piles. The entire job is to be completed in between 60 and 90 days.

The new silos are designed to hold a total of 90,000 bbl. of cement. Each is to be about 80 ft. in height. The total capacity of the four present silos is 50,000 bbl. Their height is 70 ft.

"With increased storage facilities," Mr. Harris said, "the plant will be able to operate on an increased schedule the year around. We are operating three steamers, and at the present time are employing about 175 men, counting the boat crews."—*Bay City* (Mich.) *Times.*

Contracts Let for New Cement Plant in Mexico

CONTRACTS for the construction of a $450,000 cement plant to be built at Hermosillo, Sonora, were signed recently by Francisco Elias, governor of Sonora and president of the Cemento Portland Nacional, S. A. The construction contract was given to the Macdonald Engineering Co. of Los Angeles, Calif.

The company has been under organization for several months. Ygnacio Soto, Agua Trieta, Sonora, banker, has been prominent in the promotion of the company. The plant will have a daily capacity of 500 bbl. and will be located at the base of a large limestone mountain close to the Sonora capital.—*Phoenix* (Ariz.) *Republican.*

According to the *Nogales* (Ariz.) *Herald*, the contract has been signed with the Macdonald Engineering Co. of California, general engineers. E. F. Raeside represented the company. This concern will supervise the construction of the plant. Contracts have also been signed with the Worthington Pump and Machinery Co. of New York and the Traylor Engineering and Manufacturing Co. of Allentown, Penn. A. H. Weymann is here representing the Worthington company.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[29]	6- 3-30	95	100	
Alpha P. C. new com.	6-16-30	30	31⅞	75c qu. Apr. 15
Alpha P. C. pfd.[2]	6-16-30	115	....	1.75 qu. Mar. 15
American Aggregates com.[29]	6- 3-30	20	....	75c qu. Mar. 1
Am. Aggre. 6's, bonds (w.w.)	6-17-30	85	....	
American Brick Co., sand-lime brick	6-17-30	....	5	25c qu. Feb. 1
American Brick Co. pfd.	6- 2-30	72	....	50c qu. May 1
Am. L. & S. 1st 7's[29]	6- 3-30	95	97	
American Silica Corp. 6½'s[40]	6-17-30	No market		
Arundel Corp. new com.	6-16-30	43	43¼	75c qu. Apr. 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	6-17-30	40	50	
Beaver P. C. 1st 7's[30]	6-16-30	96	100	
Bessemer L. & C. Class A[4]	6-14-30	31	33	75c qu. May 1
Bessemer L. & C. 1st 6½'s[4]	6-14-30	87	90	
Bloomington Limestone 6's[29]	6- 3-30	83	85	
Boston S. & G. new com.[47]	6-16-30	17	19½	40c qu. Apr. 1
Boston S. G. new 7% pfd.[47]	6-16-30	47	50	87½c qu. Apr. 1
California Art Tile A	6-12-30	....	12	43¾c qu. Mar. 31
California Art Tile B	6-12-30	....	4	20c qu. Mar. 31
Calaveras Cement com.	6-12-30	....	14	
Calaveras Cement 7% pfd.	6-12-30	....	89	1.75 qu. Apr. 15
Canada Cement com.	6-16-30	15	....	
Canada Cement pfd.	6-16-30	95	96	1.62½ qu. June 30
Canada Cement 5½'s[43]	6-14-30	93¾	100½	
Canada Cr. St. Corp. bonds[43]	6-14-30	95½	....	
Certain-teed Prod. com.	6-16-30	7	7¼	
Certain-teed Prod. pfd.	6-17-30	20	25	1.75 qu. Jan. 1
Cleveland Quarries	6-16-30	66	70	75c qu. 25c June 1
Columbia S. & G. pfd.	6-16-30	94	96	
Consol. Cement 1st 6½'s, A	6-17-30	85	90	
Consol. Cement 6½% notes[24]	6-17-30	70	75	
Consol. Cement pfd.[29]	6- 3-30	50	60	
Consol. Oka S. & G. 6½'s[12] (Canada)	6- 2-30	100	101	
Consol. Rock Prod. com.[20]	6-16-30	1¾	2¼	
Consol. Rock Prod. pfd.[20]	6-16-30	12½	13½	43¾c qu. June 1
Consol. Rock Prod. units	6-16-30	25½	28½	
Consol. S. & G. pfd. (Can.)	6-16-30	82	86	1.75 qu. May 15
Construction Mat. com.	6-16-30	15¾	18	
Construction Mat. pfd.	6-16-30	38¼	40	87½c qu. May 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	6-14-30	93	95	
Coosa P. C. 1st 6's[29]	6- 3-30	51½	53	
Coplay Cem. Mfg. 1st 6's[40]	6-16-30	95	....	
Coplay Cem. Mfg. com.[40]	6-16-30	10	....	
Coplay Cem. Mfg. pfd.[40]	6-16-30	60	....	
Dewey P. C. 6's (1942)	6-17-30	98	....	
Dewey P. C. 6's (1930)	6-17-30	98	....	
Dewey P. C. 6's (1931-41)	6-17-30	98	....	
Dolese & Shepard	6-16-30	81	85	$2 qu. July 1
Dufferin Pav. & Cr. Stone com.	6-16-30	....	19	
Dufferin Pav. & Cr. Stone pfd.	6-16-30	86	90	
Edison P. C. com.[39]	6-13-30	10c	....	
Edison P. C. pfd.[39]	6-13-30	25c	....	
Giant P. C. com.[2]	6-16-30	5	9	
Giant P. C. pfd.[2]	6-16-30	22	30	1.75 s.-a. June 16
Gyp. Lime & Alabastine, Ltd.	6-16-30	19¾	20	37½c qu. July 2
Hermitage Cement com.[11]	6-14-30	25	35	
Hermitage Cement pfd.[11]	6-14-30	80	90	
Ideal Cement, new com.	6-16-30	50	55	75c qu. Apr. 1
Ideal Cement 5's, 1943[33]	6-14-30	97	99	
Indiana Limestone units[29]	6- 3-30	75	85	
Indiana Limestone 6's	6-16-30	81	82	
International Cem. com.	6-16-30	62	65	$1 qu. June 27
International Cem. bonds 5's	6-16-30	101½	....	Semi-ann. int.
Iron City S. & G. bonds 6's	4-21-30	95	....	
Kelley Is. L. & T. new st'k	6-16-30	35	40	62½c qu. Apr. 1
Ky. Cons. St. com. V. T. C.[48]	6-12-30	10	11	
Ky. Cons. Stone 6½'s[48]	6-12-30	94	98	
Ky. Cons. Stone pfd.[48]	6-12-30	89	90	1.75 qu. May 1
Ky. Cons. Stone com.[48]	6-12-30	10	11	
Ky. Rock Asphalt com.[11]	6-14-30	14	16	40c qu. Apr. 1
Ky. Rock Asphalt pfd.[11]	6-14-30	85	90	1.75 qu. Mar. 1
Ky. Rock Asphalt 6½'s[11]	6-14-30	95	100	
Lawrence P. C.	6-14-30	56	63	$1 qu. Mar. 29
Lawrence P. C. 5½'s, 1942	5- 7-30	83	....	
Lehigh P. C.	6-16-30	33½	36	62½c qu. Aug. 1
Lehigh P. C. pfd.	6-14-30	106	108½	1¾% qu. July 1
Louisville Cement[7]	6-12-30	230	....	
Lyman-Richey 1st 6's, 1932[13]	6-14-30	97	99	
Lyman-Richey 1st 6's, 1935[13]	6-14-30	97	99	
Marblehead Lime 6's[14]	6-13-30	95	100	
Marbelite Corp. com. (cement products)	6-13-30	235	....	
Marbelite Corp. pfd.	6-13-30	12½	....	50c qu. July 10
Material Service Corp.	6-17-30	....	21½	50c qu. June 1
McCrady-Rogers 7% pfd.[22]	6-16-30	50	....	
McCrady-Rogers com.[22]	6-16-30	20½	21¼	
Medusa Portland Cement	6-16-30	96	....	1.50 Apr. 1
Mich. L. & C. com.[6]	6-16-30	24	....	
Missouri P. C.	6-16-30	31	32	50c qu. May 1
Monolith Portland Midwest	6-16-30	2½	3½	
Monolith bonds, 6's[9]	5-29-30	85½	87½	
Monolith P. C. com.[9]	5-29-30	3½	5	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	5-29-30	5	6	40c s.-a. Jan. 1
Monolith P. C. units[9]	5-29-30	13½	16	
National Cem. (Can.) 1st 7's[43]	6-14-30	99½	....	
National Gypsum A com.	6-16-30	5	7	
National Gypsum pfd.	6-16-30	33	36	
Nazareth Cement com.[26]	6-14-30	20	....	
Nazareth Cement pfd.[26]	6-14-30	100	....	
Newaygo P. C. 1st 6½'s[29]	6- 3-30	101½	....	
New Eng. Lime 1st 6's[14]	6-13-30	90	95	
N. Y. Trap Rock 1st 6's	6-16-30	100⅝	101	
N. Y. Trap Rock 7% pfd.[36]	6-14-30	95	....	1.75 qu. Apr. 1
North Amer. Cem. 1st 6½'s	6-16-30	63	....	
North Amer. Cem. com.	6-13-30	....	5	
North Amer. Cem. 7% pfd.[29]	6- 3-30	26	32	
North Amer. Cem. units[29]	6- 3-30	28	34	
North Shore Mat. 1st 5's[15]	6-17-30	95	....	
Northwestern States P. C.[37]	5- 5-30	110	115	$2 Apr. 1
Ohio River Sand com.	6-16-30	....	17	
Ohio River Sand 7% pfd.	6-16-30	97	....	
Ohio River S. & G. 6's[16]	6-14-30	85	90	
Oregon P. C. com.[20]	6-16-30	8	12	
Oregon P. C. pfd.[20]	6-16-30	93	97	
Pacific Coast Aggregates pfd.	6-16-30	....	11	
Pacific Coast Cement 6's[5]	3-20-30	80	85	
Pacific P. C. com.	6-12-30	....	25	
Pacific P. C., new pfd.	6-12-30	80	85	1.62½ qu. Apr. 5
Pacific P. C. 6's	6-12-30	99	....	
Peerless Cement com.[21]	6-14-30	8	9	
Peerless Cement pfd.[21]	6-14-30	80	85	1.75 Apr. 1
Penn.-Dixie Cement pfd.	6-16-30	40	50	
Penn.-Dixie Cement com.	6-16-30	8	8⅞	
Penn.-Dixie Cement 6's	6-16-30	82½	....	
Penn. Glass Sand Corp. 6's	6- 4-30	102	103	
Penn. Glass Sand pfd.	6- 4-30	112	....	1.75 qu. July 1
Petoskey P. C.	6-16-30	9	9¾	15c qu. Apr. 1
Port Stockton Cem. units[9]	2-17-30	....	30	
Port Stockton Cem. com.[20]	6-16-30	No market		
Riverside Cement com.	6-16-30	....	15	
Riverside Cement pfd.[20]	6-16-30	73	76	1.50 qu. May 1
Riverside Cement, A[20]	6-16-30	No market		31¼c Feb. 1
Riverside Cement, B[20]	6-16-30	No market		
Roquemore Gravel 6½'s[17]	6-16-30	99	100	
Santa Cruz P. C. 1st 6's, 1945[5]	3-20-30	105¾	....	6% annually
Santa Cruz P. C. com.	6-12-30	91	....	$1 qu. Apr. 1
Schumacher Wallboard com.	6-12-30	10½	12	
Schumacher Wallboard pfd.	6-12-30	21½	25	50c qu. May 15
Southwestern P. C. units[44]	6-12-30	240	....	
Standard Paving & Mat. (Can.) com.	6-16-30	20	21	50c qu. May 15
Standard Paving & Mat. pfd.	6-16-30	89	90	1.75 qu. Feb. 15
Superior P. C., A	6-12-30	37	38	27½c mo. July 1
Superior P. C., B	6-12-30	9½	11¾	25c qu. Mar. 20
Trinity P. C. units[37]	5- 5-30	120	130	
Trinity P. C. com.[37]	5- 5-30	40	....	
Trinity P. C. pfd.[29]	6- 3-30	107	....	
U. S. Gypsum com.	6-16-30	40⅝	41½	40c qu. June 30
U. S. Gypsum pfd.	6-16-30	114¼	121¾	1.75 qu. June 30
Universal G. & L. com.[3]	6-17-30	No market		
Universal G. & L. pfd.[3]	6-17-30	No market		
Universal G. & L., V. T. C.[3]	6-17-30	No market		
Universal G. & L. 1st 6's[3]	6-17-30	No market		
Warner Co. com.[16]	6-14-30	44¼	44½	50c qu. & 25c ex. July 15
Warner Co. 1st 7% pfd.[16]	6-14-30	102	106	1.75 qu. July 1
Warner Co. 1st 6's (w. w.)	6-17-30	99¾	100	
Whitehall Cem. Mfg. com.[36]	6-14-30	80	....	
Whitehall Cem. Mfg. pfd.[36]	6-14-30	50	....	
Wisconsin L. & C. 1st 6's[15]	6-17-30	95	....	
Wolverine P. C. com.	6-17-30	4½	4¾	15c qu. May 15
Yosemite P. C., A com.[20]	6-16-30	2½	3	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler Beadling & Co., Youngstown, Ohio. [5]Freeman, Smith & Camp Co., San Francisco, Calif. [6]Frederic H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simon & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [24]A. B. Leach & Co., Inc., Chicago, Ill. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Bank of Republic, Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago, Ill. [33]Boettcher Newton & Co., Denver, Colo. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Los Angeles, Calif. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co., Chicago, Ill.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked
Atlantic Gypsum Products Co. 6's, 1941, $4,000 and 40 shs. com.[1]	35%	....
Atlantic Gypsum Products 6's, 1941, $5,000; 50 shs. com. as bonus[3]	49%	....
Consolidated Cem. com. v.t.c., 3220 shs.[1]	1½ per share	....
Indiana Limestone deb. 7's, 1936, with warrants ($1,000)[4]	$500 for the lot	....

[1]Price at auction by Wise, Hobbs & Arnold, Boston, Dec. 18, 1929. [3]Price at auction by R. L. Day & Co., Boston, Dec. 18, 1929. [4]Price at auction by Adrian H. Muller & Son, Dec. 26, 1929.

Newaygo Portland Cement Co. Balance Sheet

THE Newaygo Portland Cement Co., Newaygo, Mich. (now a part of the Medusa Portland Cement Co.) reports its balance sheet as of March 1, 1930, as follows:

ASSETS	
Land, buildings, equipment, etc.	$2,003,583
Routes, leases, agencies, etc.	1,763,416
Current assets:	
Cash	628,930
Accounts and notes receivable	219,340
Inventories	61,585
Other notes receivable	29,890
Organization expense	157,513
Deferred charges	157,047
Total	$5,021,304
LIABILITIES	
Class A stock	$2,500,000
Common stock	422,960
Bonded debt	1,600,000
Current liabilities:	
Accounts payable	215,622
Notes payable	80,026
Accruals	73,086
Federal taxes	19,797
Surplus	109,813
Total	$5,021,304
Current assets	$ 909,855
Current liabilities	388,531
Working capital	$ 521,324

Florida Portland Cement Co.'s Balance Sheet to December 31, 1929

THE REPORT of the Florida Portland Cement Co., Tampa, Fla., shows a net deficit of $503,921 for the period of October 1, 1927, to December 31, 1929. The balance sheet as of December 31, 1929, is as follows:

ASSETS:	1929	1928
Property and equipment	$5,081,851	$5,006,305
Organization expenses	691,884	693,653
Current assets:		
Inventories	314,929	305,738
Cash	170,377	407,742
Sundry receivables, etc.	162,507	78,101
Investments	7,532	8,128
Deferred charges	96,040	133,239
Total	$6,525,120	$6,632,906
LIABILITIES:		
Preferred stock	$4,997,100	$5,000,000
*Common stock	1,100	1,100
Bonded debt	1,641,000	1,697,500
Current liabilities:		
Accounts payable, etc.	70,030	101,022
Depreciation, reserves, etc.	319,810	189,449
Deficit	503,921	356,165
Total	$6,525,120	$6,632,906
Current assets	647,813	791,581
Current liabilities	70,030	101,022
Working capital	$ 577,783	$ 690,559

*Represented by 75,000 no-par shares.

Arundel Corporation Earnings

ARUNDEL CORP. reports net profits of $234,308 in April, against $23,239 in the same month a year ago; for four months of 1930, earnings were $629,882 after all charges and taxes against $440,405 in 1929.

Gypsum, Lime and Alabastine, Ltd., to Be Traded in New York

THE Gypsum, Lime and Alabastine, Ltd., Paris, Ont., has been granted unlisted trading privileges for its 2,000,000 shares of no-par common stock on the New York Stock Exchange.

Balance Sheet of Standard Paving and Materials, Ltd.

THE Standard Paving and Materials, Ltd., Toronto, Ont., one of the principal producers of sand, gravel and crushed stone in Canada, reports the following earnings statement and balance sheet as of March 31, 1930:

Net operating profit	$ 747,150
Other income	58,838
Total income	805,987
Federal taxes	42,856
Depreciation and depletion	200,000
Other deductions	8,864
Net profit	554,267
Preferred dividends	183,580
Common stock	209,744
Surplus	$ 160,943
Earned per share, common	$3.53
Number of common shares, 104,872.	

CONSOLIDATED BALANCE SHEET AS OF MARCH 31, 1930

ASSETS	
*Property account	$2,273,730
Investments, affiliated companies	22,560
Patents and good-will	683,025
Organization expense	70,240
Current assets:	
Cash	169,333
Marketable securities	429,517
Accounts receivable (net)	330,165
Warrants and cash deposited	55,104
Inventories	54,161
Cash value, life insurance	10,960
Deferred charges	51,873
Total	$4,150,667
LIABILITIES	
Preferred stock	$1,444,500
Common stock (104,872 no par shares	105,223
Consolidated Sand and Gravel preferred stock	1,102,700
Mortgage payable	40,648
Current liabilities:	
Accounts and accruals payable	137,739
Dividends unclaimed	31
Federal taxes	68,667
Reserves	78,946
Earned surplus	1,143,824
Capital surplus	28,389
Total	$4,150,667
Current assets	$1,049,239
Current liabilities	206,437
Working capital	$ 842,802

*Less depreciation and depletion, $1,108,238.

Lehigh Portland Cement Earnings

REPORT of Lehigh Portland Cement Co. for year ended May 31, 1930, shows net income of $1,942,019 after depreciation, federal taxes, etc. After deduction of 7% preferred dividends paid, balance of $471,298 is equal to $1.05 a share (par $50) on 450,348 shares of common stock. This compares with net income of $4,108,567 in preceding year, equal after preferred dividends, to $5.74 a share on common.

Recent Dividends Announced

Cleveland Builders Supply (qu.)	$0.50	July 1
Consumers Co. prior pfd. (qu.)	1.50	July 1
Dolese and Shepard (qu.)	2.00	July 1
Gypsum, Lime and Alabastine Canada, Ltd. (qu.)	0.37½	July 2
Lehigh P. C. com. (qu.)	0.62½	Aug. 1
Marbelite Corp. of America (cement products) pfd.	0.50	July 10
Pennsylvania Glass Sand pfd. (qu.)	1.75	July 1
Republic P. C. pfd. (qu.)	1¾%	June 1
Superior P. C. A (mo.)	0.27½	July 1

McCrady-Rodgers Co. Balance Sheet

THE McCRADY-RODGERS CO., sand and gravel producers, Pittsburgh, Penn. (whose preferred stock offering was published in ROCK PRODUCTS, March 29), reports a balance sheet as of December 31, 1929, as follows:

ASSETS	
Real estate, plant and equipment	$2.700,810
Investments	31,543
Current Assets:	
Cash	481,475
Bills receivable	52,468
Accounts receivable	755,567
Uncompleted contracts (net)	199,375
Inventories	264,358
Deferred charges	76,272
Total	$4,561,868
LIABILITIES	
Preferred stock	$ 650,000
Common stock (144,353 no par shares)	721,765
Bonded debt	650,000
Current Liabilities:	
Accounts payable	198,328
Accruals	46,594
Federal tax	37,000
Depreciation reserve	73,660
Capital surplus	2,011,236
Earned surplus	173,285
Total	$4,561,868
Current assets	$1,753,243
Current liabilities	355,582
Working capital	$1,397,661

Balance Sheet of the Marquette Cement Mfg. Co.

THE BALANCE SHEET of the Marquette Cement Manufacturing Co., Chicago, Ill., as of January 1, 1930, is reported as follows:

ASSETS:	1930	1929
Property account	$16,805,017	$15,157,660
Current assets:		
Marketable securities	1,230,774	2,083,382
Cash	509,583	607,858
Accounts and notes receivable	567,933	627,738
Inventories	1,382,229	1,123,072
Miscellaneous	824,696	694,571
Total	$21,320,232	$20,294,281
LIABILITIES:		
Preferred stock	$ 4,438,700	$ 4,568,700
Common stock	3,443,200	3,443,200
Bonded debt	4,280,000	4,550,000
Current liabilities:		
Accounts payable, etc.	460,255	803,093
Accruals	331,494	308,188
Reserves	3,842,283	3,039,661
Surplus	4,524,298	3,581,439
Total	$21,320,232	$20,294,281
Current assets	3,690,519	4,442,050
Current liabilities	791,749	1,111,281
Working capital	$ 2,898,770	$ 3,330,769

British Cement Earnings

THE Associated Portland Cement Corp., London, England, shows a revenue of £935,000, which with the addition brought forward leaves available £1,075,000. A dividend of 8% was declared. Depreciation amounted to £267,000 and £141,000 was brought forward.

Called for Payment

PENNSYLVANIA Glass Sand Corp. 1st 6s, 1952, in amount of $55,000, have been called for payment at 105 on July 1, 1930, at Brown Bros. and Co., New York, Boston and Philadelphia.

Foreign Abstracts and Patent Review

Influence of Sands on Cement Mortars. Prof. P. P. Budnikoff has determined the influence of sand taken from six different deposits upon the tensile and compressive strengths of portland cement from three different cement plants. The test results indicate that the various kinds of sand effect a differing influence upon the cements. However, a simple relation between the influence of the various kinds of cement could not be deducted. Therefore the author recommends (for Russia) the use of the standard Wolsk sand in all tests in order to preclude possible errors in testing.—*Zement* (1929 **18**, 49, pp. 1410-1411.

German Definitions for Aggregates. O. Gassner presents a general discussion on aggregates, including sand, gravel, crushed rock, pumice sand, pumice gravel, lava, slag and blast furnace slag. His definitions for various aggregates are given below:

Sand (Sand) is a naturally or artificially reduced rock substance having a granulation from 0 to 5 mm.

Gravel (Kies) is a naturally reduced rock of a granulation of 5 mm. and above.

Gravel-sand (Kiessand) is a natural mixture of the two above-named aggregates.

Stone fragments or stone splinters (Steingrus or Steinsplitt) is the artificially reduced rock classified between 5 and 25 mm. granulation.

Broken stone (Steinschlag, Schotter) is rock sized by hand or machine to a granulation of about 25 to 70 mm.

Another classification lists the following terms:

Fragments (Grus) has a granulation of 5 to 12 mm.

Splinters (Splitt) has a granulation of 15 to 25 mm.

Another classification lists sand (Sand) as the throughs on the 7-mm. circular-hole screen, which is sub-classified into dust-fine sand (Staubfeines) which is the throughs of the 900-mesh screen.

Fine sand (Feinsand) which is the throughs of the 1-mm. perforation screen.

Coarse sand (Grobsand) which is the residue on the 1-mm. round-hole screen.

Coarse (Grobes) which is the residue on the 7-mm. round-hole screen and the throughs on the 30-mm. round-hole screen.

For testing the granular composition of the aggregates, at least two screens are to be used, one with 7-mm. holes and one with 1-mm. holes; 5 kg. of the dried aggregate is screened on the large screen and the throughs on the fine screen. The aggregate is considered to have a very good granular composition when there are 40 to 50% throughs on the 7-mm. screen with 60 to 50% overs. The sand is very well granulated when its proportion is 10 to 30% fine sand and 90 to 70% coarse sand.

The following granular sizes are being proposed: Screened: screened to 2-mm. size, gravel of 2- to 30-mm. size, broken stone (Schotter) of 30- to 70-mm. size. Not screened: fine gravel sand of 0- to 5-mm. size, medium gravel sand of 5- to 15-mm. size, gravel sand of 15- to 30-mm. size. For reduced material: sand to 3-mm. granulation, fragments from 2- to 12-mm. granulation, splinters from 12- to 25-mm. granulation and crushed rock from 25- to 65-mm. granulation.—*Zement* (1930) **19**, 1, pp. 9-13.

The Hydrates of Calcium Carbonate. The literature on the hydrates of calicum carbonate is summarized. The authors have succeeded in preparing the pure hexahydrate for the first time. In addition to the anhydrous carbonate and the hexahydrate, there exists also a monohydrate as a definite chemical compound. The hexahydrate decomposes very rapidly at ordinary temperatures. It is stable at 0 deg. C. in air, *in vacuo* and in alcohol. Decomposition commences at 8 deg. C. and progresses rapidly. The decomposition product is in all cases calcite. The monohydrate was prepared by dehydrating the hexahydrate in the tensi-eudiometer. A micro-tensi-eudiometer used for the dehydration experiments is described. The densities of the hydrates have been determined and the molecular volume of the water calculated therefrom.—F. Krauss and W. Schriever: *Zeit. anorg. Chem.* (1930) **188**, 259-73.

Equipment of an "Ultra-Modern" French Plaster Plant. J. Prouteau states that in the year 1923 the firm Jannot, of Triel-sur-Seine, started, in agreement with the firm Vernon of Paris, to build driers and rotary kilns and also special rotary burners for gypsum plasters. At the present the firm has at least 25 installations to its credit, in capacities from 2 to 12 tons per hour. Fig. 1 shows the installation of a plaster plant for the production of 5 tons per hour. It contains the following equipment: Jaw crusher (1), grinder with perforated floor (2), reserve hopper for ground gypsum (3), rotary disc distributor (4), spiral conveyor (5) feed to kilns, two rotary kilns (12) for building plaster, grinder (7) with perforated floor for burned plaster, elevator (8), bolting mill (9) for fine plaster for coating, feeding screw (10) of bolting mill, discharge (11) for fine coating plaster. Special blades are attached to the inside lining of the tube to help deliver the gypsum to the opposite end.—*Revue des Materiaux de Construction et de Travaux Publics* (1929), 237, pp. 201-205.

Lime and Sand-Lime Brick Manufacture. If the lime "blows" or swells, in

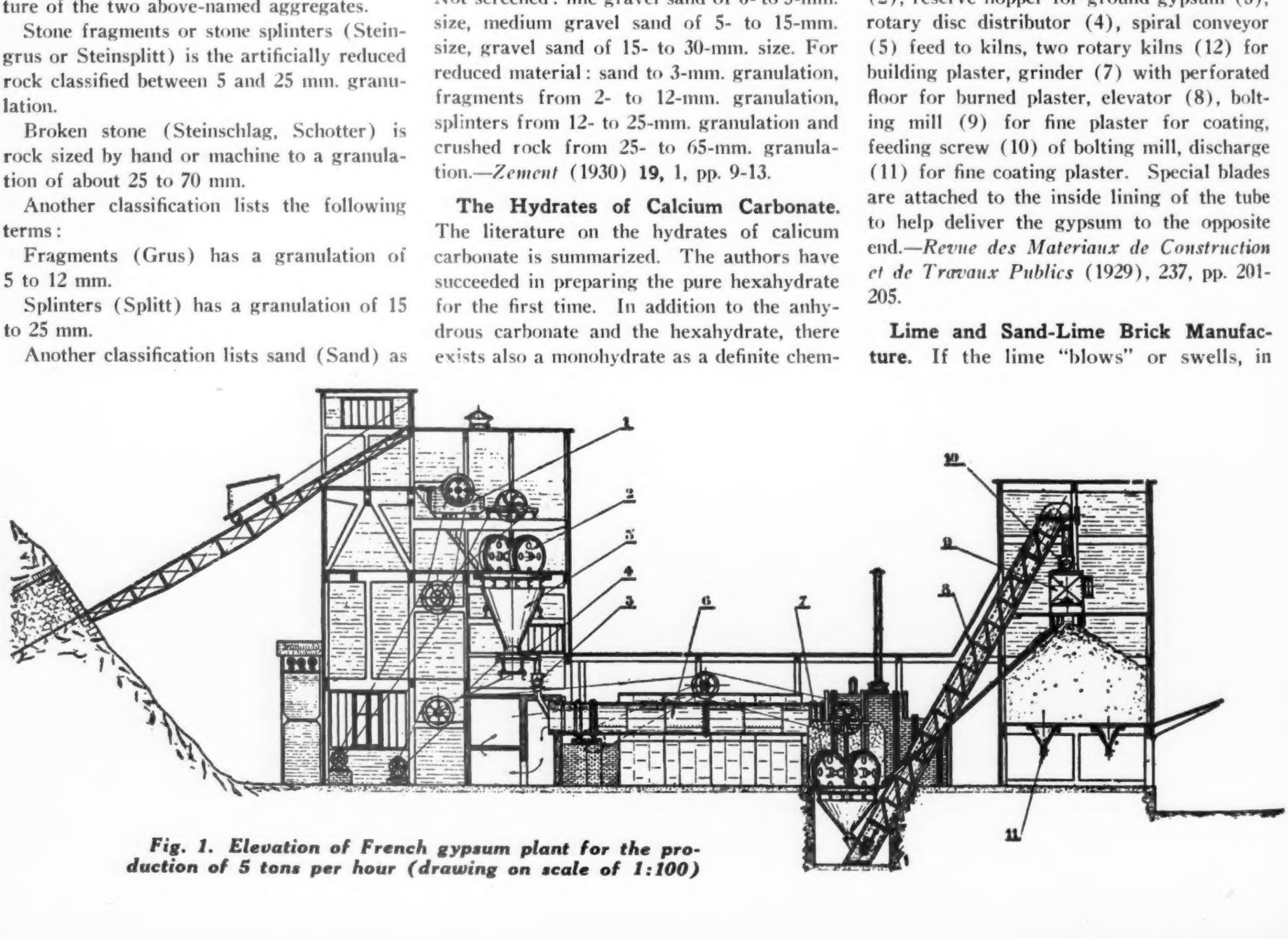


Fig. 1. Elevation of French gypsum plant for the production of 5 tons per hour (drawing on scale of 1:100)

sand-lime-brick manufacture, it should be ground finer and slaked completely. The silicatic limes, which are frequently designated as hydraulic limes, are a usable lime for sand-lime brick. A pulverized lime accepted for use in sand-lime-brick manufacture resulted in the crumbling of the brick while being hardened, due apparently to subsequent slaking. The chemical analysis of the lime was as follows: water, 8.96%; carbonic acid, 5.15%; insoluble in acid, 2.53%; soluble in acid: silicic acid, 6.01%; alumina, 3.09%; ferric oxide, 1.03%; calcium oxide, 71.30%; magnesium oxide, 1.96%; total, 100.03%. The sieve tests showed a residue of 0% on No. 4, 4.3% on No. 10 and 27.5% on No. 30. The lime was therefore strongly silicatic, not fully slaked and ground coarsely. It is desired for building lime when there is no residue on sieve No. 10 and not more than 10% on sieve No. 30. This lime when slaked in the hardening kiln itself at 8 atmospheres of steam pressure assured perfect sand-lime bricks.—*Tonindustrie-Zeitung* (1929) **53**, 99, p. 1732.

Si-Material, Trass and Diatomaceous Earth. P. Mecke discusses the chemical behavior of Si-material, trass and diatomaceous earth in lime mortar and cement mortar. The following conclusions may be drawn from the test results: The action of lime upon trass is based almost wholly upon the formation of lime silicate; on the other hand, calcium sulpho-aluminate, lime silicate and calcium aluminate arise from Si-material and lime. The above named lime compounds are formed in lime mortar and in cement mortar only in a slight measure, especially when it dries soon and absorbs carbonic acid. Only after an extended exposure to water, gradually increasing quantities of lime are fixed. The increase in the fixing of lime and the hydrolytic disintegration of cement is dependent upon the quantity and the lime content of the affecting water.—*Tonindustrie-Zeitung* (1930) **54**, 26, pp. 444-446.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

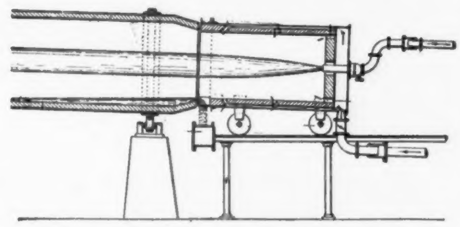
Manufacture of Transparent Fused Pure Silica. The present invention is a method of manufacturing transparent fused pure silica in which there is utilized compact siliceous rocks employed without grinding. The method of fusion constituting the first phase of the process has for its object to obtain the fusion, without deformation, of the rock constituting the primary material in such a way as to avoid bringing the blemished regions into mixture with the sound regions. It is pointed out that if such a condition is realized, it will become possible after cooling to divide up the fused mass along the planes containing the flaws in such a way as to eliminate the defective regions.

The operation consists in arranging the blocks in an electric melting furnace in the midst of a mass of pure siliceous sand, very carefully packed around them, and in proceeding to the fusion of the whole group.

The second phase of the process consists in dividing up this ingot by mechanical means for the elimination of blemished parts by cutting them up along the planes defined by the flaws. Those pieces which do not show optical homogeneity are again treated.—*Henri George, Paris, France, assignor to Societe Quartz and Silice, Paris, France. U. S. No.* 1,755,953.

Kiln for the Manufacture of Fused Cement. This invention relates to a method of manufacturing fused cement that has the advantage of greater fuel economies when compared to common kiln processes.

The use of a rotary kiln for the manufacture of fused cement has advantages over other processes because it permits the use as a combustible of any coal, natural gas, generator gas, petroleum oil or the like.

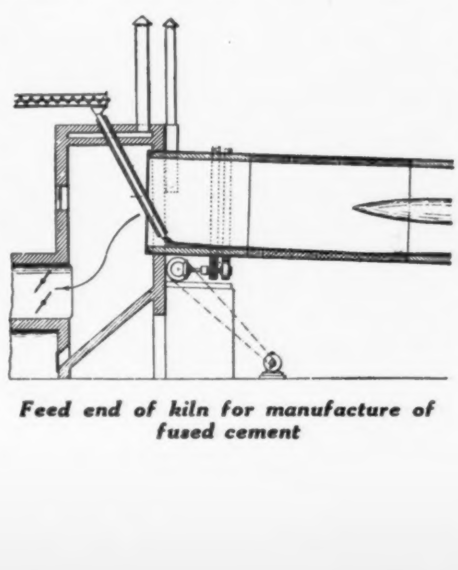


Firing end of proposed kiln for producing fused cement

Attempts to carry out the manufacture of fused cement by means of a rotary kiln have met with a limited amount of success because the existing rotary kilns for clinkering portland cement have been employed without modification. The process is rendered impossible after a few hours by the formation at the discharge end of the kiln of solid rings preventing the flow of cement and in the advance end of the kiln of heaps or rings which obstruct the feeding of the raw material.

The object of the present invention is to provide an apparatus enabling these disadvantages to be overcome and the industrial manufacture of fused cement to be accomplished in a rotary kiln.

In accordance with this invention, the material intended for making fused cement is treated by dehydrating and decarbonizing at about 1000 deg. C., although the material is in a zone of flame of a higher temperature.



Feed end of kiln for manufacture of fused cement

The material is then passed to a zone of intense heat wherein a temperature of 1600 deg. C. to 1700 deg. C. is maintained, where it fuses suddenly as soon as the decarbonation is complete.

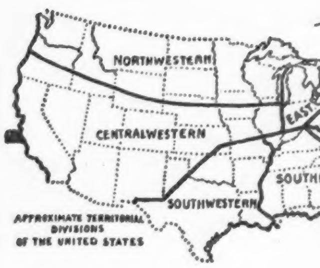
Under these circumstances neither heaps nor rings can form in the fore part of the kiln with their accompanying disadvantages. —*Antoine Bauchere and Gabriel Arnou, Paris, France, U. S. No.* 1,758,778.

Byproduct Gypsum. The present invention is intended to utilize calcium sulphates, the byproduct from the manufacture of phosphoric acid. When this byproduct gypsum is to be recovered as stucco, difficulties arise in the processing of the gypsum so produced, for when such byproduct gypsum is treated by neutralization as in Patent No. 1,548,358, and calcined into stucco, it is found that certain amounts of phosphoric acid and fluorine compounds are regenerated or made active by the temperature used in calcination.

It generally becomes necessary to perform a certain chemical treatment of this gypsum after preliminary washing over filters or by other means. While careful washing alone will reduce the direct water soluble impurities in such gypsum, such washed gypsum upon drying and calcining invariably will be found to contain certain water soluble acidulous impurities which react with a weakening and retarding effect on the calcined plaster, causing great reduction in strength, plasticity and other qualities which go toward making marketable stucco. Also in calcining such gypsum, even if treated by the usual methods of neutralization with sodium or other salts, these compounds regenerate into acid water soluble compounds at the calcination temperatures.

In the treatment of byproduct gypsum from phosphoric acid manufacture to improve the crystalline strength of plaster and to reduce the water soluble impurities formed as outlined, the patentee proposes to convert the impurities in the byproduct by a mineral acid treatment and neutralize the resultant acidity. The author of the patent recommends sulphuric acid as the mineral acid and lime as the neutralizing agent.—*Robert Seaver Edwards, U. S. No.* 1,756,637.

Method of Preparing Di-Calcium Phosphate. The inventor describes a process for utilizing gaseous hydrochloric acid and producing available di-calcium phosphate by bringing gaseous hydrochloric acid into contact with a water suspension of pulverized phosphate rock, thereby decomposing the phosphate rock and taking into solution phosphoric acid and mono-calcium phosphate; adding calcium carbonate to this solution to neutralize the first hydrogen ion of its free phosphoric acid and its hydrochloric acid, then precipitating di-calcium phosphate with calcium hydroxide, and separating the precipitate from the solution.—*Robert D. Pike, U. S. No.* 1,753,478.



Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended May 17	May 24	Sand, Stone and Gravel Week ended May 17	May 24
Eastern	3,432	3,263	10,945	10,996
Allegheny	3,084	3,104	8,047	7,974
Pocahontas	753	643	1,588	535
Southern	748	556	8,537	8,212
Northwestern	1,069	1,289	6,357	6,949
Central Western	483	505	12,618	12,687
Southwestern	591	539	6,310	6,575
Total	10,160	9,899	54,402	53,928

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1929 AND 1930

District	Limestone Flux 1929 Period to date May 25	1930 May 24	Sand, Stone and Gravel 1929 Period to date May 25	1930 May 24
Eastern	58,087	52,517	112,874	92,704
Allegheny	65,120	51,587	86,034	87,199
Pocahontas	6,492	7,079	12,291	17,947
Southern	9,715	13,839	159,734	145,414
Northwestern	17,839	15,787	65,825	54,174
Central Western	10,838	10,014	153,571	160,256
Southwestern	9,056	8,507	111,929	111,554
Total	177,147	159,330	702,258	669,248

COMPARATIVE TOTAL LOADINGS, 1929 AND 1930

	1929	1930
Limestone flux	*177,147*	*159,330*
Sand, stone, gravel	*702,258*	*669,248*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning June 14:

CENTRAL FREIGHT ASSOCIATION DOCKET

25166. To establish on **dolomite, burned or roasted**, carloads (See Note 3), Cedarville, O., to Chicago, Ill., rate of $2.15 per net ton. Present rate, $2.70 per net ton per C. F. A. L. Tariff 130T and P. R. R. Tariff 11B.

25174. (a) To amend C. F. A. L. Tariff 213N, Item 35, naming rate of $6.30 per car on **stone, chip or waste**, from Ellettsville, Ind., etc., to grinding plants located at Bedford, Ind., on the C. I. & L. Ry., by including Bloomington and Clear Creek, Ind., as origin points. (b) To add a new item which will read: "From mills and quarries at Ellettsville, Bloomington and Clear Creek to grinding plants on C. M. & St. P. and P. R. R. at Oolitic, rate of $12.60 per car."

25175. To establish on **sand, viz., blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing loam, molding or silica**, carloads (See Note 3), from Centreton and Campbells, Ind., to Canton, Ill., rate of $2.52 per net ton. Present rate, $3.53 per net ton.

25176. To establish on **agricultural limestone**, in bulk, in open-top cars; **crushed stone**, in bulk, in open-top cars; **stone, rip rap**, in open cars; **stone screenings**, in bulk, in open cars, and **stone tailings**, in bulk, in open cars, carloads, from Greencastle and Limedale, Ind., to Fort Wayne, Ind., $1.26 per net ton. Present rates, classification basis.

25178. To establish on **rip rap stone**, carloads (See Note 3), Amherst, O., to Detroit, Mich., rate of $1.35 per net ton. Route—Via N. Y. C. R. R. direct. Present rate, $2.30 per net ton.

25183. To establish on **sand and gravel**, carloads (See Note 3), Howard, O., to Zanesville, O., rate of 80c per ton of 2000 lb. Present rate, 120c per ton of 2000 lb.

25184. To establish on **sand and gravel**, carloads (See Note 3), Dresden, O., to Mt. Perry, O., rate of 75c per ton of 2000 lb. Present rate, 80c per ton of 2000 lb.

25185. To establish on **sand and gravel**, carloads (See Note 3), Dresden, O., to Hebron, O., rate of 75c per ton of 2000 lb. Route—Via Heath, O., and N. Y. C. R. R. Present rate, 90c per ton of 2000 lb.

25186. To establish on **molding sand**, carloads (See Note 3), Erie, Penn., to Batavia, N. Y., rate of 12½c. Route—Via Buffalo, N. Y., and N. Y. C. R. R. Present rate, 14½c.

25187. To establish on **gravel and sand**, carloads (See Note 3), Dresden, O., to Holmesville, O., rate of 85c per ton of 2000 lb. Present rate, 90* per ton of 2000 lb. (*Rate applies on gravel; rate on sand, 110c.)

25188. To establish on **lake and beach sand**, carloads (See Note 2), Grand Haven, Mich., to South Haven, Mich., rate of $1.26 per net ton. Present rate, $1.39 per net ton.

25189. To establish on **gravel and sand**, except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads (See Note 3), Shore Acres, N. Y., to Sherman, N. Y., rate of 90c per ton of 2000 lb. Present rate, 11½c.

25195. To establish on **sand**, carloads (See Note 3), from Wapakoneta, O.

To	Via	Prop. rate, 6th class Cwt.	Present rate, commodity Net ton
Bluffton, O.	NKP	10½	70
Cairo, O.	DT&I	10	60
Columbus Grove, O.	DT&I	10	65
Findlay, O.	NKP	13	80
Leipsic, O.	DT&I	11½	80
Lima, O.	DT&I	9	50
Ottawa, O.	DT&I	11½	75

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

25199. To establish on **phosphate rock, crude**, ground (not acidulated), in bulk, bags or barrels or lump in bulk, carloads, minimum weight 20 gross tons of 2240 lb., Evansville, Ind., to points in Indiana, Pennsylvania, Illinois and Grafton, W. Va., rates as illustrated in Exhibit "A" attached. Present rates, as illustrated in Exhibit "A" attached.

EXHIBIT "A"

Statement of Rates on Phosphate Rock, from Evansville, Ind., to Representative Points

	Pres.	Prop.
Attica, Ind.	265	265
Bryce, Ill.	265	265
Carlisle, Ind.	202	202
Clark, Ind.	302	302
Coal Bluff, Ind.	265	265
Connellsville, Penn.	582	582
Doggett, Ind.	202	202
El River, Ind.	202	202
Elnora, Ind.	202	202
Fairland, Ind.	265	265
Fort Wayne, Ind.	302	302
Goodland, Ind.	265	265
Gravel Pit, Ind.	202	202
Hillsdale, Ind.	265	265
Huntington, Ind.	302	302
Indiana, Penn.	602	602
Jordan, Ind.	202	202
La Crosse, Ind.	265	265
Lacon, Ind.	265	265
Mecca, Ind.	265	265
Mt. Silica, Ind.	265	265
North Terre Haute, Ind.	265	265
Otter Creek Junction, Ind.	265	265
Pence, Ind.	265	265
Pimento, Ind.	202	202

25215. To establish on **stone, crushed**, in bulk in open-top cars, carloads (See Note 3), Thrifton, O., to Martins Ferry, O., $1.60 per net ton. Present rate, $1.70 per net ton.

25202. To establish on **fluxing stone**, carloads (See Note 3), from West Columbus, O.

To	Pres.	Prop.
Ashland, Ky.	$1.27*	$1.01*
Barberton, O.	.17†	.92*
Columbus, O.	.08†	.40*
Jackson, O.	.85*	.76*
Ironton, O.	1.27*	1.01*
Marion, O.	.12†	.92*
Mingo Junction, O.	.18†	1.05*
Steubenville, O.	.18†	1.05*
Portsmouth, O.	1.27*	1.01*

From C. F. A. territory to Official Classification territory, except Canada.

*Per gross ton. †Per hundredweight.

25224. To establish on **sand (all kinds) and gravel**, in open-top cars, carloads (See Note 3). Rates in cents per ton of 2000 lb. Route—Via Cleveland, O.

To	From Akron, O. Prop.	Pres.	Krumroy, O. Prop.	Pres.
Wickliffe, O.	80	85	80	85
Willoughby, O.	80	90	80	90
Mentor, O.	80	90	....	....

25225. To establish on **sand (lake, river and bank)** other than sand loam, carloads (See Note 3), from Miller (Gary district), Ind., to Hoopeston and Danville, Ill., $1.39 per net ton. Present rate, $1.64 per net ton.

25226. To establish on (A) **sand, viz., blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, (B) sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), North Judson, Ind., to St. Joseph, Mich., rates (A) $1.26 and (B) $1.17 per net ton. Present rates, classification basis.

25227. To establish on **agricultural limestone**, in bulk, in open-top cars; **crushed stone**, in bulk, in open cars; **stone, rip-rap**, in open cars, **stone screenings**, in bulk, in open cars, carloads (See Note 3), Greencastle and Limedale, Ind., to East St. Louis, Ill., rate of $1.26 per net ton. Present rate, classification basis.

25228. To establish on **crushed stone**, in open-top cars, in bulk only, and **stone screenings**, in open-top cars, in bulk only, in straight or mixed carloads (See Note 3), from Kokomo, Ind., rate of 60c per net ton to Curtisville and 65c per net ton to Elwood and Frankton, Ind. Present rate, 70c per net ton.

25229. To establish on **crushed stone**, carloads (See Note 3), from Kenton, O., to Decatur and Rivare, Ind., rate of 95c per ton of 2000 lb. Present rates, $1.05 and $1.04 per net ton to Decatur and Rivare, Ind., respectively.

25234. To establish on **sand and gravel**, carloads (See Note 3), from Troy, O., to destinations in Ohio and Union City, Ind., rates as shown in Exhibit "D" attached. Present rates as shown in Exhibit "D" attached.

EXHIBIT "D"

	Prop.	Pres.
Dayton & Union R. R.		
Representative points		
Union City, Ind.	....	95
Hill Grove, O.	90	....
Greenville, O.	85	....
Gordon, O.	80	....
National Road, O.	80	....
Trotwood, O.	60	....
Routes—B. & O. R. R., Dayton, O., D. & U. R. R.		
Baltimore & Ohio R. R.		
Representative points		
Washington C. H., O.	90	100
Rosemoor, O.	85	90
Orphans Home, O.	80	90
Barrs, O.	70	80
Route—B. & O. R. R. direct.		
Pennsylvania R. R.		
Eaton, O.	100	100

25235. To establish on **sand and gravel**, carloads (See Note 3), from Wapakoneta, O. (rates in cents per net ton):

To	Prop.	Pres.
Oakwood, O.	90c	Class
Rimer, O.	75c	Class
Jenera, O.	80c	Class
Mt. Blanchard, O.	85c	Class

Routes—Oakwood, O., via B. & O. R. R., Leipsic Jct., O., N. Y. C. & St. L. Ry.; Rimer, O., via B. & O. R. R., Columbus Grove, O., N. O.

Ry.; Jenera, O., via B. & O. R. R., Columbus Grove, O., N. O. Ry.; Mt. Blanchard, O., via B. & O. R. R., Columbus Grove, O., N. O. Ry.

25237. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), Montezuma, Ind., to Brocton, Ill., rate of 84c per net ton. Route—B. & O. R. R., Metcalf, Ill., N. Y. C. & St. L. Ry. (Clover Leaf district). Present rate, 90c per net ton.

25242. To establish on **crushed stone**, carloads (See Note 3), from Huntington, Ind. (rates in cents per ton of 2000 lb.):

To	Prop.	Pres.
Columbia City, Ind.	85	240
Churubusco, Ind.	90	240

Route—Via Wabash Ry., Ft. Wayne, Ind., and P. R. R.

25246. To establish on **crushed stone**, carloads (See Note 3), Keeport, Ind., to Fremont, O., rate of $1.55 per ton of 2000 lb. Route—(a) Via Wabash Ry., Toledo, O., and N. Y. C. R. R.. (b) Via Wabash Ry., Toledo, O., and W. & L. E. Ry.

25247. To establish on **crushed stone**, carloads (See Note 3), from Keeport, Ind. (rates in cents per ton of 2000 lb.):

To	Prop.	Pres.
Bronson, Ill.	110	320
Fithian, Ill.	110	340
Muncie, Ill.	110	340
Oakwood, Ill.	110	320

Routes—Via Wabash Ry., Danville, Ill., and C. C. C. & St. L. Ry., or I. T. R. R. System.

25249. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) **and gravel**, carloads (See Note 3), Wolcottville, Ind., to Michigan City, Ind., rate of $1.05 per ton of 2000 lb. Route—Via Wabash Ry., Dillon, Ind., and N. Y. C. & St. L. R. R. Present rate, 15c.

25253. To establish on **sand, blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica**, carloads (See Note 3), Falconer, N. Y., to Cleveland, O., $1.51, and to Detroit, Mich., $2.39 per ton of 2000 lb. Present rates, $2.27 to Cleveland, O., and $2.77 to Detroit, Mich., per ton of 2000 lb.

25259. To establish on **crushed stone and crushed stone screenings**, carloads (See Note 3), Huntington, Ind., to Silver Lake, Ind., 75c per ton of 2000 lb. Present rate, $1 per ton of 2000 lb.

25260. To establish on **crushed stone**, carloads (See Note 3), North Baltimore, O., to West Oberlin, O., rate of $1 per net ton. Route—Via Monroeville, W. & L. E., L. & W. Va. delivery. Present rate, $3 per net ton.

25265. To establish on **sand, silica**, carloads (See Note 3), from Muscatine, Ia., and Browntown, Wis., to destinations in C. F. A. territory as named in Agent Boyd's Tariff 41-P, rates as shown in Exhibit "A" attached.

EXHIBIT "A"

From Muscatine, Ia.

To	Present rate Processed	Crude
South Bend, Ind.	*$2.90	$2.27
Indianapolis, Ind.	2.77	2.39
Toledo, O.	3.28	.....
Ft. Wayne, Ind.	3.03	2.77
Detroit, Mich.	3.28	.....
Grand Rapids, Mich.	3.28	3.03

From Muscatine, Ia.

To	Proposed rate Processed	Crude
South Bend, Ind.	$2.40	$2.00
Indianapolis, Ind.	2.64	2.20
Toledo, O.	3.00	2.50
Ft. Wayne, Ind.	2.64	2.20
Detroit, Mich.	3.24	2.70
Grand Rapids, Mich.	2.88	2.40

From Browntown, Wis.
(Present rates, classification basis)

To	Proposed rate Processed	Crude
South Bend, Ind.	$2.16	$1.80
Indianapolis, Ind.	2.52	2.10
Toledo, O.	2.76	2.30
Ft. Wayne, Ind.	2.40	2.00
Detroit, Mich.	2.76	2.30
Grand Rapids, Mich.	2.16	1.80

*Silica sand only.

TRUNK LINE ASSOCIATION DOCKET

23727. **Sand and gravel**, carloads (See Note 2), from Farmingdale and South Lakewood, N. J., to Irvington, N. J., $1 per net ton. Present rate, $1.10 per net ton. Reason—To meet motor truck competition.

23728 (Cancels rate proposals 21022 and 21471). To revise the rates on **building and engine sand**, in open-top equipment (See Note 2), from Berkeley Springs, Hancock and Great Cacapon, W. Va., and Hancock and Round Top, Md., to points west of Cumberland, Md., on the B. & O., Monongahela Ry., P. & L. E. and W. Md. Ry. Rates ranging from 90c to $1.70 per net ton. It is also proposed to cancel rates from and to points involved on building and engine sand, in other than open-top equipment. Class rates to apply on such traffic in future. Reason—The proposed rates in general are the same as prescribed by the I. C. C. in Docket 19841 in connection with rates on the above commodities from Cumberland, Md., to B. & O. R. R., Monongahela Ry., P. & L. E. Ry. and W. Md. Ry., west thereof for distances up to 200 miles. Same basis was ordered established by the P. S. C. of Pennsylvania, from Mapleton district, Penn., to Pennsylvania state destinations for distances up to 200 miles in P. S. C. of Penn. 7950.

23730. **Sand, blast, core, engine, fire, foundry, glass, molding, quartz, silex or silica**, carloads (See Note 2), from Oakmont, Penn., to Scottdale, Penn., $1.17 per net ton. Reason—Proposed rate compares favorably with rates on like commodities for like distances, services and conditions.

23733. **Sand and gravel**, carloads (See Note 2), from Farmingdale and South Lakewood, N. J., to Chatsworth, N. J., sand 70c and gravel 80c per net ton. (Present rate, $1.04 per net ton.) Reason—To meet motor truck competition.

23737. **Sand**, other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads, and/or **gravel**, carloads (See Note 2), from Arundel, Md., to Collington, Md., 65c per net ton. (Present rate, 75c per net ton.) Reason—To meet motor truck competition. Also comparable with rates on like commodities from and to points in the same general territory.

23738. (A) **Sand and gravel**, when loaded in open-top equipment, carloads; (B) **sand and gravel**, when loaded in box cars or other closed equipment, carloads (See Note 2), from Cape May, Dennisville and Palermo, N. J., to Philadelphia, Penn., (A) $1.15 and (B) $1.25 per net ton. Reason—Proposed rates are comparable with rates on like commodities from and to points in the same general territory.

23739 (cancels 22615). (A) **Limestone, ground**, carloads, minimum weight 50,000 lb., and (B) **Lime, agricultural, and limestone, ground**, mixed carloads, minimum weight 50,000 lb., from Leesburg, Va., to points on the B. & O. R. R. as follows: Washington Branch—Hyattsville, Brentwood, Md., Langdon, D. C.; Georgetown Branch—Chevy Chase, Bethesda, Md., Georgetown, D. C.; Metropolitan Branch—University, Terra Cotta, Chillum, Lamond, Takoma Park, D. C., North Takoma, Silver Spring, Linden, Forest Glen, Kensington, Garrett Park, Md.: (A) $1.80, and (B) $2 per net ton. Reason—Proposed rates are fairly comparable with rates from Engle, W. Va., Frederick, Md., etc., to W. & O. D. Ry. stations.

23742. **Sand**, N. O. I. B. N., in Southern Classification, carloads (See Note 1), from Tatesville, Penn., to Erwin and Kingsport, Tenn., 25c per 100 lb. Reason—Proposed rate is comparable with rates from the Mapleton district.

23749. **Sand, common building** (not blast, engine, fire, foundry, glass, molding or silica) **and gravel**, carloads (See Note 2), from Tioga, Penn., to Cedar Run, Slate Run, Cammal, Blue Stone, Jersey Mills, Waterville, Ramseys Tombs, Furnace Run and Jersey Shore, Penn., $1 per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

23759. **Ground limestone**, carloads, minimum weight 50,000 lb., from Bellefonte and Pleasant Gap, Penn.

To	Prop.	Pres.
Forest Grove, N. J.	15½	16
Richland, N. J.	16	20½
Pleasantville, N. J.	16	20½

23784. **Limestone, ground, precipitated and pulverized, and limestone dust**, carloads, minimum weight 50,000 lb., from Lime Crest, N. J., to Springfield, Baltusrol and Summit, N. J., 8c per 100 lb. Reason—Proposed rate is comparable with rate to Newark, N. J.

23803. **Sand**, other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads (See Note 2), from Burnham, Penn., to Audenried, Penn., $1.60, and Jeddo, Penn., $1.70 per net ton. Reason—Proposed rates are comparable with rates to Excelsior, Natalie, Reading and Locust Summit, Penn.

23471. Amend rate proposal No. 23471 applying on **stone, viz., fire and ganister**, carloads (See Note 2), from Barree, Brookes Mills, Cumberland, Md., etc., to C. F. A. territory by adding as points of origin Berkeley Springs, W. Va., at same rates as proposed from Cumberland, Md.

23720. **Sand**, carloads (See Note 2), from Pinewald and Quail Run, N. J., to Whitings, N. J., 60c per net ton. Rate to expire December 31, 1930.

23804. **Sand and gravel**, other than blast, engine, foundry, glass, molding or silica, carloads (See Note 2), from Susquehanna, Penn., to State Line Jct., N. J., to Millerton, Penn., inclusive, $1.20 per net ton. Present rate, $1.35 per net ton. Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions.

23813. **Sand, common, building**, carloads (See Note 2), from Pierce, W. Va., to Paw Paw, W. Va., $1.40, Moorefield, W. Va., $1.80, and Petersburg, W. Va., $1.90 per net ton. Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions.

23819. **Limestone, ground, precipitated and pulverized, and limestone dust**, carloads, minimum weight 50,000 lb., from Lime Crest, N. J., to L. & N. E. stations Swartswood Jct., N. J., to Sussex, N. J., 6c per 100 lb. (Present rate, 7½c per 100 lb.) Reason—Proposed rate is comparable with rate on like commodities from and to points in the same general territory.

23620. **Sand, viz., engine, glass, common, etc., and flint, ground**, as per Item 6385C of Agent Curlett's I. C. C. A265, observing the same minimum weight as shown in this item from Hancock, Round Top and Tonolaway, Md., to Cincinnati, O., $3.30, and Chillicothe, O., $2.90 per net ton.

23856. **Sand**, carloads (See Note 2), from Masonville to South Pemberton, N. J., inclusive—to Blackwood, N. J., $1.50 per net ton. Reason—Proposed rate is comparable with rates to Williamstown and Grenlock, N. J.

SOUTHERN FREIGHT ASSOCIATION DOCKET

50726. **Ground phosphate rock**, from Augusta, Ga. (when the crude rock originates at Florida mines), to Athens, Ga. Present rate, 245c per net ton. Proposed rates on ground phosphate rock, carloads, minimum weight 80% of marked capacity of car, except that actual weight will govern where cars are loaded to their full visible carrying capacity and the actual weight is less than 80% of the marked capacity, but in no case less than 60,000 lb.—from Augusta, Ga. (when the crude rock originates at Florida mines), to Athens, Ga., 110c per ton of 2240 lb.

50794. **Phosphate rock**, from Florida mines to Bloomington, Ill. It is proposed to cancel, on the obsolete theory, the present published rate of 949c per net ton on phosphate rock, carloads, from Florida mines named in A. C. L. R. R. I. C. C. B2536 and S. A. L. Ry. I. C. C. A7315, to Bloomington, Ill. Lowest combination rate of 1006c per gross ton to apply after cancellation.

50802. **Asbestos sand, refuse or shorts**, from Danville, Que., to southern points. It is proposed to establish commodity rates on asbestos sand, refuse or shorts, carloads, minimum weight 60,000 lb., from Danville, Que., to southern points, made the same as applicable from Quebec Central Mines, for application via rail-water-rail routes, and including marine insurance.

50811. **Sand and gravel**, from Johnsonville and Perryville, Tenn., to Covington, Tenn. In lieu of combination rates it is proposed to establish rate of 135c per net ton on sand and gravel, in straight or mixed carloads (See Note 3), from Johnsonville, Tenn., and on sand, carloads (See Note 3), from Perryville, Tenn., to Covington, Tenn.

ILLINOIS FREIGHT ASSOCIATION DOCKET

2961-A. To cancel specific commodity rates on **sand** (except blast, core, engine, filter, fire, etc.), carloads, from Morocco, Ind., to points in Illinois and Indiana shown on page 163 of N. Y. C. I. C. C. L. S. 1413, and permit class rates to apply in lieu thereof, account pit abandoned.

4951. **Sand**, carloads, from Ft. Madison, Ia.

To (representative points)	Pres.*	Prop.†
Quincy, Ill.	9½	$1.00
Marblehead, Ill.	10	1.05
New Canton, Ill.	11½	1.20
Stillwell, Ill.	9½	1.00
Basco, Ill.	9½	.95
Ferris, Ill.	8½	.90
Dallas City, Ill.	6	.85
Ray, Ill.	11½	1.40

*Per 100 lb. †Per net ton.

5679. **Sand and gravel**, carloads, from Chester and Kellogg, Ill., to stations on the L. & N. R. R. in Illinois (representative points).

To	Pres.	Prop.	To	Pres.	Prop.
Maunie	*	$1.35	Ashley	$1.26	$1.00
Trumbull	*	1.25	Okawville	*	1.10
Dahlgren	$1.26	1.15	Belleville	*	1.20
Drivers	1.26	1.05	*Combination.		

5703. **Crushed stone**, carloads, from Krause and Stolle, Ill. (See Note 1), to Illinois Terminal stations, Riverton to Decatur, inclusive. Present rates, class; proposed, 98c per ton. Rates to Decatur will be net to I. T. R. R. and connecting line switching charge will not be absorbed.

5710. **Crushed stone**, carloads (See Note 2), from Krause and Stolle, Ill., to Marshall, Ill. Present rate, $1.31; proposed, $1.26.

5712. **Sand and gravel**, carloads (See Note 1), from Moronts, Ill., to Cabery, Buckingham and Kempton, Ill. (rates per net ton):

To	Pres.	Prop.
Buckingham	$1.22	$1.15
Cabery	1.34	1.15
Kempton	1.34	1.15

WESTERN TRUNK LINE DOCKET

774-C. **Stone, rubble**, carloads, between points in W. T. L. territory. Description, present, stone, rubble; proposed, stone, rubble, valued not in excess of $2 per ton at point of origin.

1564-Z. **Stone, crushed**, carloads (See Note 3), but not less than 40,000 lb. will apply, from Dell Rapids, S. D., to Beresford, S. D. Present rate, $1.40; proposed, $1.18.

Portland Cement Output in May

Production and Shipments Show Increase Over Last Year

THE portland cement industry in May, 1930, produced 17,271,000 bbl., shipped 17,210,000 bbl. from the mills, and had in stock at the end of the month 30,928,000 bbl., according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in May, 1930, showed an increase of 6.9% and shipments an increase of 3.0%, as compared with May, 1929. Portland cement stocks at the mills were 4.4% higher than a year ago.

The statistics here presented are compiled from reports for May, from all manufacturing plants except four for which estimates have been included in lieu of actual returns.

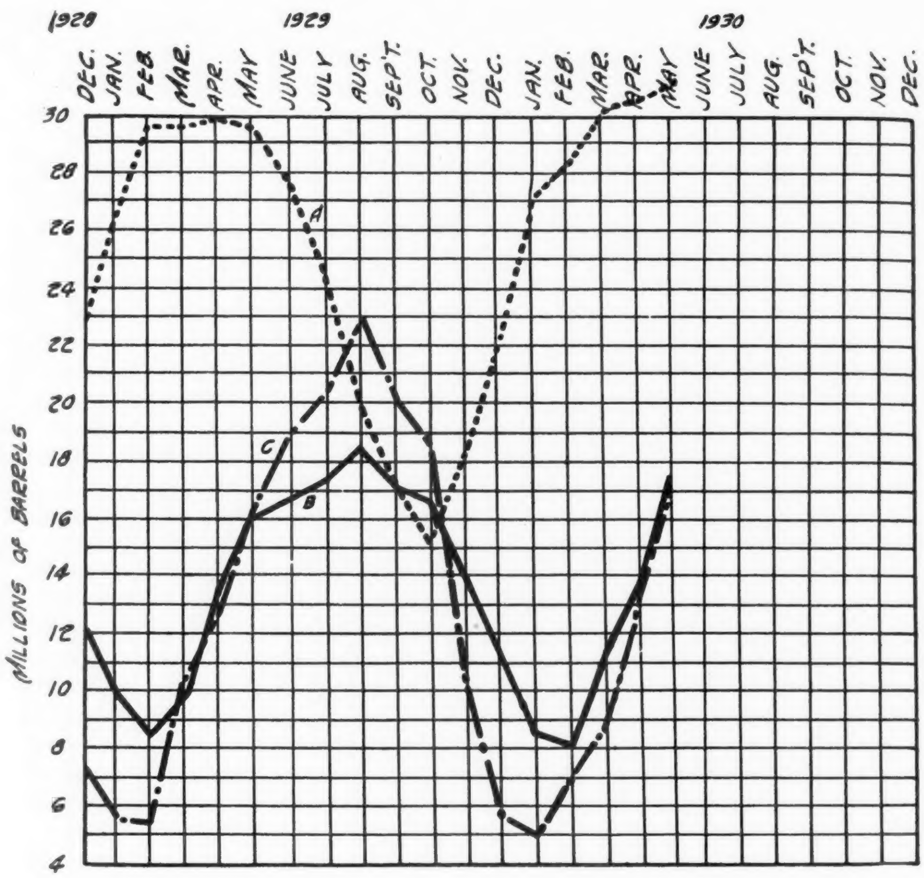
In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 166 plants at the close of May, 1930, and of 161 plants at the close of May, 1929. In addition to the capacity of the new plants which began operating during the twelve months ended May 31, 1930, the estimates include increased capacity due to extensions and improvements at old plants.

RELATION OF PRODUCTION TO CAPACITY

	May 1929 Pct.	May 1930 Pct.	April 1930 Pct.	March 1930 Pct.	Feb. 1930 Pct.
The month	76.4	78.9	64.0	51.5	41.5
12 months ended	70.2	66.2	66.0	66.1	65.6

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during March and April, 1929 and 1930:



(A) Stocks of finished portland cement at factories; (B) Production of finished portland cement; (C) Shipments of finished portland cement from factories

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN MARCH AND APRIL, 1929 AND 1930, IN BARRELS*

Shipped to	1929—March	1930	1929—April	1930
Alabama	127,916	104,750	166,925	126,501
Alaska	525	864	1,778	2,988
Arizona	57,406	44,917	51,150	45,312
Arkansas	93,133	86,481	99,392	130,247
California	1,063,895	720,008	973,052	824,463
Colorado	59,854	57,317	99,991	85,644
Connecticut	106,492	109,085	†158,992	184,816
Delaware	19,112	19,467	31,219	32,573
District of Columbia	86,492	70,893	97,218	82,913
Florida	100,388	87,400	101,227	104,898
Georgia	95,061	101,858	139,353	139,155
Hawaii	22,366	22,829	24,308	26,240
Idaho	20,842	18,305	26,923	25,650
Illinois	612,069	379,453	1,069,018	694,367
Indiana	251,934	201,551	365,104	386,945
Iowa	123,637	117,907	215,629	447,570
Kansas	217,559	†178,877	285,944	283,917
Kentucky	102,241	72,496	163,059	118,156
Louisiana	104,285	285,435	105,290	374,620
Maine	19,229	33,975	34,197	64,470
Maryland	131,729	172,822	169,575	257,033
Massachusetts	165,380	191,190	†226,181	320,443
Michigan	474,902	344,412	785,443	599,371
Minnesota	136,193	91,055	220,077	248,088
Mississippi	75,353	56,606	76,425	42,812
Missouri	342,697	264,930	405,208	529,829
Montana	20,068	18,316	49,313	37,562
Nebraska	88,438	83,042	106,392	153,348
Nevada	9,755	11,923	10,848	15,637
New Hampshire	32,824	19,963	†42,946	45,594
New Jersey	485,067	456,109	689,358	623,867
New Mexico	25,796	23,641	33,100	35,730
New York	1,285,742	†1,095,878	†1,598,671	1,556,095
North Carolina	159,570	101,751	224,791	141,565
North Dakota	16,912	20,791	62,207	39,253
Ohio	564,820	425,559	849,359	823,451
Oklahoma	318,321	283,365	309,739	381,939
Oregon	80,134	101,258	79,593	72,861
Pennsylvania	716,114	†700,482	†960,745	1,088,646
Porto Rico	420	2,125	975	1,300
Rhode Island	43,300	45,477	65,457	73,396
South Carolina	100,091	62,241	131,517	81,105
South Dakota	32,110	28,448	40,519	36,414
Tennessee	140,815	143,103	231,259	236,120
Texas	621,387	618,703	694,150	713,051
Utah	28,712	40,937	46,663	53,292
Vermont	24,984	23,132	†33,872	32,457
Virginia	138,772	120,043	176,266	148,622
Washington	214,280	214,098	255,250	276,475
West Virginia	70,720	75,381	93,098	120,687
Wisconsin	197,738	159,096	352,986	299,210
Wyoming	7,672	9,934	12,491	15,870
Unspecified	28,531	†40,274	†20,771	14,500
	10,063,783	†8,759,953	†13,265,014	13,297,068
Foreign countries	49,217	66,047	†59,986	42,932
Total shipped from cement plants	10,113,000	†8,826,000	13,325,000	†13,340,000

*Includes estimated distribution of shipments from three plants in March and April, 1929; from two plants in March and April, 1930.
†Revised.

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1929 AND 1930, IN BARRELS

Month	1929—Production	1930	Stock at end of month 1929	1930
January	12,012,000	10,504,000	9,642,000	9,646,000
February	11,255,000	10,008,000	12,436,000	11,572,000
March	12,450,000	13,045,000	14,948,000	13,503,000
April	14,166,000	15,025,000	15,479,000	*15,164,000
May	15,444,000	16,628,000	14,911,000	14,654,000
June	15,312,000	....	13,587,000	....
July	15,214,000	....	11,619,000	....
August	15,829,000	....	8,995,000	....
September	15,165,000	....	7,009,000	....
October	15,515,000	....	5,934,000	....
November	14,087,000	....	6,134,000	....
December	12,539,000	....	7,526,000	....

*Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN MAY, 1929 AND 1930, AND STOCKS IN APRIL, 1930, IN BARRELS

District	Production 1929	Production 1930	Shipments 1929	Shipments 1930	Stocks at end of month 1929	Stocks at end of month 1930	Stocks at end of Apr. 1930
Eastern Penn., N. J., Md.	3,541,000	3,707,000	3,967,000	3,746,000	6,355,000	6,998,000	7,037,000
New York	1,137,000	1,176,000	1,184,000	1,191,000	2,195,000	1,847,000	1,862,000
Ohio, West'n Penn., W. Va.	1,595,000	2,111,000	1,660,000	1,974,000	3,711,000	4,102,000	3,965,000
Michigan	1,387,000	1,419,000	1,322,000	1,229,000	2,724,000	2,785,000	2,595,000
Wis., Ill., Ind. and Ky.	2,065,000	2,143,000	2,356,000	2,026,000	4,052,000	4,808,000	4,691,000
Va., Tenn., Ala., Ga., Fla., La.	1,276,000	1,306,000	1,301,000	1,192,000	2,117,000	1,865,000	1,751,000
East'n Mo., Ia., Minn., S. D.	1,548,000	1,763,000	1,649,000	2,184,000	4,261,000	3,628,000	4,049,000
Western Mo., Nebr., Kansas, Okla. and Ark.	1,117,000	1,360,000	1,007,000	1,390,000	1,527,000	1,807,000	1,837,000
Texas	655,000	630,000	563,000	620,000	535,000	836,000	8[illegible]5,000
Colo., Mont., Utah, Wyo., Ida.	363,000	325,000	334,000	283,000	521,000	582,000	540,000
California	1,142,000	938,000	1,066,000	973,000	997,000	1,095,000	1,130,000
Oregon and Washington	325,000	393,000	297,000	402,000	629,000	575,000	585,000
	16,151,000	17,271,000	16,706,000	17,210,000	29,624,000	30,928,000	30,867,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1929 AND 1930, IN BARRELS

Month	Production 1929	Production 1930	Shipments 1929	Shipments 1930	Stocks at end of month 1929	Stocks at end of month 1930
January	9,881,000	8,498,000	5,707,000	4,955,000	26,797,000	27,081,000
February	8,52[illegible],000	8,162,000	5,448,000	7,012,000	29,870,000	*28,249,000
March	9,969,000	11,225,000	10,113,000	*8,826,000	29,724,000	*30,648,000
April	13,750,000	13,521,000	13,325,000	*13,340,000	30,151,000	*30,867,000
May	16,151,000	17,271,000	16,706,000	17,210,000	29,624,000	30,928,000
June	16,803,000	....	18,949,000	....	27,505,000	....
July	17,315,000	....	20,319,000	....	24,525,000	....
August	18,585,000	....	23,052,000	....	20,056,000	....
September	17,223,000	....	19,950,000	....	17,325,000	....
October	16,731,000	....	18,695,000	....	15,381,000	....
November	14,053,000	....	11,222,000	....	18,213,000	....
December	11,215,000	....	5,951,000	....	23,550,000	....
	170,198,000	....	169,437,000	....	304,711,000	....

PRODUCTION AND STOCKS OF CLINKER (UNGROUND CEMENT), BY DISTRICTS, IN MAY, 1929 AND 1930, IN BARRELS

District	Production 1929	Production 1930	Stocks at end of month 1929	Stocks at end of month 1930
Eastern Pennsylvania, New Jersey and Maryland	3,463,000	3,543,000	2,616,000	2,340,000
New York	1,089,000	1,067,000	1,382,000	986,000
Ohio, Western Pennsylvania and West Virginia	1,591,000	1,988,000	1,804,000	1,749,000
Michigan	1,229,000	1,204,000	1,376,000	1,847,000
Wisconsin, Illinois, Indiana and Kentucky	1,946,000	2,197,000	2,356,000	2,544,000
Virginia, Tennessee, Alabama, Georgia, Florida, Louisiana	1,143,000	1,403,000	1,232,000	1,074,000
Eastern Missouri, Iowa, Minnesota and South Dakota	1,491,000	1,802,000	1,157,000	1,221,000
Western Missouri, Nebraska, Oklahoma and Arkansas	1,094,000	1,272,000	751,000	446,000
Texas	617,000	596,000	187,000	379,000
Colorado, Montana, Utah, Wyoming and Idaho	323,000	299,000	533,000	159,000
California	1,067,000	893,000	933,000	1,326,000
Oregon and Washington	391,000	364,000	584,000	583,000
	15,444,000	16,628,000	14,911,000	14,654,000

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1929 AND 1930

Month	Exports 1929 Barrels	Exports 1929 Value	Exports 1930 Barrels	Exports 1930 Value	Imports 1929 Barrels	Imports 1929 Value	Imports 1930 Barrels	Imports 1930 Value
January	78,639	$283,002	82,387	$293,135	151,302	$177,976	201,609	$207,461
February	58,886	225,590	64,267	217,798	118,930	123,123	114,455	119,717
March	69,079	235,164	117,563	357,896	131,909	112,788	43,622	59,981
April	64,145	218,316	57,419	200,217	89,668	114,281	140,871	178,226
May	57,955	219,366	....	....	200,646	267,854	....	....
June	96,055	287,612	....	....	203,545	228,170	....	....
July	71,992	247,177	....	....	182,098	199,960	....	....
August	60,013	225,762	....	....	183,938	199,403	....	....
September	86,268	308,631	....	....	112,372	152,239	....	....
October	101,359	337,839	....	....	172,566	187,504	....	....
November	53,378	198,197	....	....	96,568	95,844	....	....
December	88,403	297,255	....	....	84,358	79,098	....	....
	886,172	$3,083,911	....	....	1,727,900	$1,938,240	....	....

Exports and Imports

These figures were compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision:

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN APRIL, 1930

Exported to	Barrels	Value
Canada	5,746	$22,516
Central America	3,599	9,343
Cuba	4,848	11,651
Other West Indies and Bermuda	3,505	7,848
Mexico	16,368	48,843
South America	19,413	76,101
Other Countries	3,940	23,915
	57,419	$200,217

IMPORTS OF HYDRAULIC CEMENT, BY COUNTRIES AND BY DISTRICTS, IN APRIL, 1930

Imports from	District into which imported	Barrels	Value
Belgium	Los Angeles	25	$41
	Massachusetts	62,901	79,612
	Philadelphia	29,418	40,463
	Porto Rico	3,106	4,131
	Total	95,450	$124,247
Canada	Maine & N. H.	75	$186
Denmark	Porto Rico	12,034	$16,929
France	New York	985	$2,144
Norway	Maryland	25	$39
United K'gd'm.	New York	22,870	$24,353
	Philadelphia	9,432	10,328
	Total	32,302	34,681
	Grand total	140,871	$178,226

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO IN APRIL, 1930

	Barrels	Value
Alaska	1,221	$3,691
Hawaii	30,099	74,666
Porto Rico	775	1,750
	32,095	$80,107

Retail Prices of Various Rock Products Materials

THE TABLE below gives average prices paid May 1, 1930, by contractors for various rock products, delivered on the job at different principal cities of the United States. These prices were secured through the Bureau of Census.

AVERAGE RETAIL PRICES FOR ROCK PRODUCTS MATERIALS, MAY 1, 1930

City	Portland cement, per bbl. excl. of cont.	Gypsum wallboard, 3/8-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, 3/4-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.90	....	$20.00	$1.50	$2.25	....
New London, Conn.	2.80	$25.00	26.00	1.50	3.00	$18.00
Waterbury, Conn.	3.00	30.00	20.00	1.35	2.45	20.00
New Bedford, Mass.	2.85	25.00	23.50	1.75	3.00	17.50
Haverhill, Mass.	2.80	25.00	20.00	2.00	......	....
Poughkeepsie, N. Y.	2.04	....	....	2.25	2.20	....
Albany, N. Y.	2.97	24.75	18.00	......	......	17.10
Rochester, N. Y.	3.25	22.00	22.00	2.50	2.40	17.00
Buffalo, N. Y.	3.10	25.00	18.00	2.50	2.05	14.00
Paterson, N. J.	2.60	26.00	18.00	1.50	2.10	17.50
Trenton, N. J.	2.40	26.00	18.00	1.50	2.10	17.50
Scranton, Penn.	2.80	....	20.00	3.25	......	19.00
Philadelphia, Penn.	2.30	....	15.50	1.85	2.65	19.75
Harrisburg, Penn.	2.60	24.30	14.40	3.10	1.60	16.65
Baltimore, Md.	2.40	....	13.00	2.00	2.75	16.00
Washington, D. C.	2.65	25.00	14.00	......	......	17.00
Richmond, Va.	3.10	31.00	17.50	1.95	2.45	20.00
Fairmount, W. Va.	2.80	35.00	16.00	3.15	3.50	18.00
Columbia, S. C.	2.80	....	17.50	1.25	......	17.00
Atlanta, Ga.	3.10	....	21.00	3.38	3.25	20.00
Savannah, Ga.	2.25	25.00	20.00	1.75	5.50	16.00
Louisville, Ky.	2.52	....	15.50	......	2.43	16.00
Tampa, Fla.	2.60	....	20.00	2.00	4.00	20.00
Erie, Penn.	2.40	22.50	19.00	2.25	......	16.00
Akron, Ohio	$2.67	$20.00	$18.00	$2.00	$3.00	$18.00
Columbus, Ohio	2.75	23.00	17.50	2.25	2.50	15.00
Toledo, Ohio	3.00	22.50	20.00	2.25	2.75	....
Cincinnati, Ohio	2.94	24.75	16.40	2.63	2.55	....
Cleveland, Ohio	2.80	....	16.00	1.95	2.70	15.50
Youngstown, Ohio	2.95	....	20.00	3.71	2.75	....
Detroit, Mich.	2.60	21.00	14.80	2.75	3.00	....
Terre Haute, Ind.	3.00	28.00	18.00	1.65	3.50	20.00
Chicago, Ill.	2.20	20.00	17.00	1.50	1.90	15.00
Milwaukee, Wis.	2.60	25.00	12.00	2.00	2.00	18.00
Lansing, Mich.	2.75	....	22.00	2.25	2.25	16.00
Des Moines, Iowa	2.66	23.75	20.00	1.60	3.60	....
St. Louis, Mo.	2.45	....	18.00	2.70	1.90	17.00
Kansas City, Mo.	2.50	25.00	24.00	1.88	1.88	15.00
St. Paul, Minn.	2.75	21.00	21.00	1.40	2.00	16.00
Sioux Falls, S. D.	2.80	27.00	26.00	1.50	2.25	16.00
Denver, Colo.	3.20	....	23.00	1.25	1.15	18.00
Grand Forks, N. D.	2.80	25.00	....	2.60	......	16.00
San Antonio, Texas	2.82	37.00	20.00	2.00	2.35	18.15
Tucson, Ariz.	3.17	38.00	30.00	1.25	2.50	15.00
Los Angeles, Calif.	1.72	34.00	24.00	1.00	1.30	17.50
Long Beach, Calif.	1.76	34.00	26.00	1.95	2.20	17.50
San Francisco, Calif.	2.60	....	22.50	1.40	1.60	19.00
Seattle, Wash.	2.10	35.00	22.00	1.25	......	20.00

Lehigh Cement Men Celebrate Over Safety Awards

Highest Company Officials on Hand to Participate in Dedications at Birmingham and Iola

TWO OF THE FOUR MILLS of the Lehigh Portland Cement Co. to win the Portland Cement Association safety awards for 1929 conducted ceremonies incident to officially receiving the awards during the first week in June.

On Tuesday, June 3, the Lehigh plant at Tarrant City, a suburb of Birmingham, Ala., unveiled the first association trophy to be seen in the southeastern states. On Thursday, June 5, a large celebration was held at the Iola, Kan., plant of the Lehigh organization in honor of the third dedication of its association trophy, signifying the completion on December 31 of three calendar years without lost time, permanent disability or fatal mishap.

Both celebrations were attended by Col. E. M. Young, president of Lehigh; Daniel E. Ritter, vice-president, in charge of operations, and Lieut.-Col. Henry A. Reninger, in charge of safety and welfare work, who journeyed from company headquarters at Allentown, Penn., for the occasion.

Two charming daughters of safety committeemen pulled the strings that unveiled the monument at the Lehigh Tarrant City celebration

Enthusiasm at Birmingham

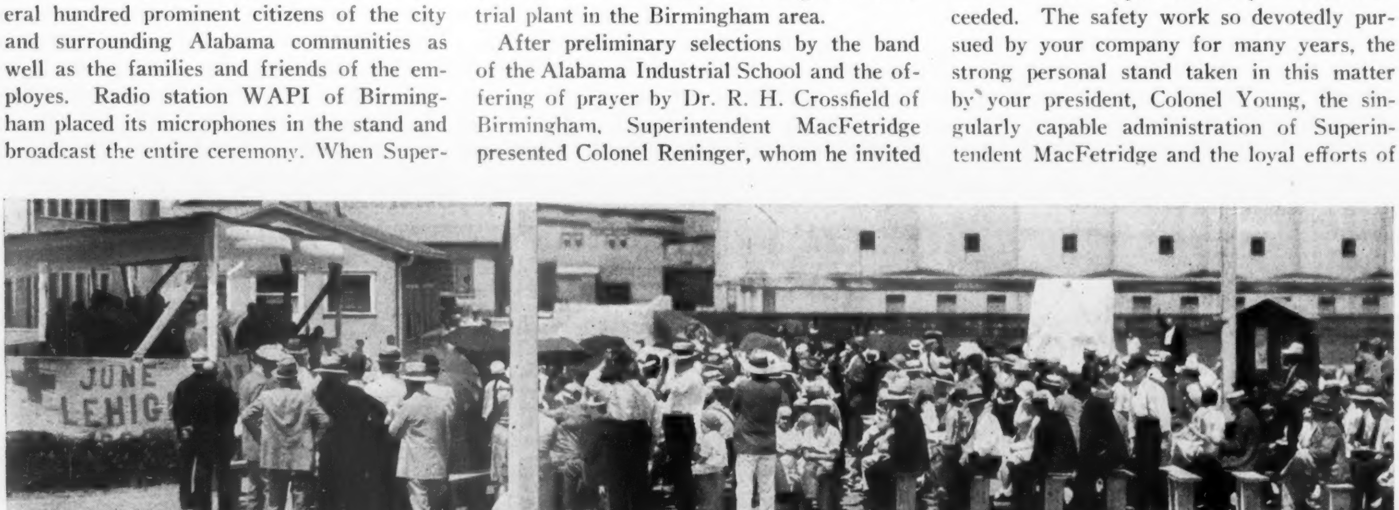
The Birmingham celebration attracted several hundred prominent citizens of the city and surrounding Alabama communities as well as the families and friends of the employes. Radio station WAPI of Birmingham placed its microphones in the stand and broadcast the entire ceremony. When Superintendent W. H. MacFetridge opened the proceedings shortly after 10 o'clock the rostrum had been filled with what was undoubtedly the most distinguished local group ever to meet in the midst of a great industrial plant in the Birmingham area.

After preliminary selections by the band of the Alabama Industrial School and the offering of prayer by Dr. R. H. Crossfield of Birmingham, Superintendent MacFetridge presented Colonel Reninger, whom he invited to preside. Colonel Reninger then introduced A. J. R. Curtis, assistant to the general manager of the Portland Cement Association, who presented the trophy to the plant on behalf of the association. Mr. Curtis said:

"Those who are acquainted with even a few of the hazards with which men are confronted in the manufacture of cement must marvel that any cement mill organization could operate for a full year or even a much shorter period without a lost-time accident to any workman.

"Only a short time ago it was conceded that a mill had to have accidents and many of them in the ordinary process of turning out the product. Your raw material is torn from these Alabama hillsides by the gigantic force of dynamite. Into your fiery kilns you feed coal pulverized so fine that it is as explosive as black powder. Your great grinding mills are turned by forces of electricity whose momentary contact would lay low an army. You have carried on for much over a year without mishap to a single employe, earning the admiration of your community and the respect of our entire industry.

"I am not surprised that you have succeeded. The safety work so devotedly pursued by your company for many years, the strong personal stand taken in this matter by your president, Colonel Young, the singularly capable administration of Superintendent MacFetridge and the loyal efforts of



Lehigh Portland Cement Co. dedicates its safety award trophy with fitting ceremonies at Tarrant City, Ala.

The bag house at Tarrant City was turned into a dining room to accommodate nearly 800 guests at the dedication. Several hundred more colored employes and their families were entertained similarly in the sacking department

every workman are the four aces by which you have won.

"If there is a fifth ace in your deck, it is the spirit you have cultivated in your organization which impels you to strive for nothing short of the highest and best by methods which never fall short of the fairest and most efficient. The spirit of fair play and brotherly regard has made accidents among you intolerable.

"It is now my privilege, acting on authority of the board of directors and on behalf of the members of the Portland Cement Association throughout America, to turn over to you the Portland Cement Association safety trophy for 1929 and with it congratulations and best wishes to every member of your organization who has contributed to your splendid record.

"The concrete monument which we are dedicating here today is unique in that it is erected in honor of the living, rather than the departed. It symbolizes achievement, rather than bereavement. It stands here overlooking this great plant, throbbing with productive activity, in happy contrast with the sombre setting of monuments erected in the silent cities of the dead. Rather than a token of work laid down, it expresses acknowledgment of a work well begun.

"The need for safe thinking is perpetual and no season, month, day or instant is free from the possibility of injury unless every man in your organization is constantly on the alert. We sincerely hope that this monument, bearing added inscriptions commemorating future perfect records, will serve as a constant inspiration and reminder."

As Mr. Curtis finished the last sentence of his remarks, Misses Betty Harris and Fay Walters, youthful daughters of two of the safety committeemen, pulled the strings which dropped the sheets revealing the trophy to view. The band played and the cheering was long and profuse as the design of the big monument was seen.

Superintendent MacFetridge then accepted the trophy on behalf of the Birmingham mill organization, expressing the determination to win many reinscriptions for perfect records during future years.

President Young was introduced next and from his manner it was not difficult to discern the delight which he felt in the achievement of his southern organization. Colonel Young said:

"For most of you who work in the Lehigh organization this is probably the first glimpse you have had of your president. I hope you are not disappointed. Possibly some of you expected to see a larger man; others may have expected a smarter man or a better looking man, but, however, that may be I beg you to accept me as I am."

From the lusty round of cheers it was evident that the crowd had done so.

The 1929 safety committee at the Tarrant City trophy winning plant. Rear row, left to right, W. R. Moore, J. M. O'Brien, C. D. Scott, R. H. MacFetridge, C. F. Walters, C. E. Harris and I. W. Cunliff. Front row, R. E. Gudgen, A. Layton, O. C. Brown, A. Carlson, H. E. Scoggins, W. A. Craig and W. H. Jones

The 1929 safety committee at the Iola, Kansas, plant. First row, left to right, J. G. Stadler, C. E. Russell, C. A. Swiggett, E. C. McCoy, M. M. Kellenberger; second row, W. A. Woodruff, J. O. Myers, R. D. Moritz, J. A. Fisher, J. B. Moyer, Ben Chambers; third row, R. E. McDonald. A. A. Brune, M. H. Creviston, C. W. Gilbert, C. E. Kietzman, J. E. Clark; fourth row, L. Carter, W. B. Ledford and H. A. Snyder

Colonel Young then traced rapidly the development of accident prevention work in the Portland Cement Association from its inception in 1912 and in the Lehigh Portland Cement Co., starting shortly thereafter. He displayed intimate knowledge of the progress made and paused occasionally to flavor his remarks with an antidote, congratulatory telegram or reference to several recent public recognitions of Lehigh safety work.

In the course of his remarks President Young received and read the following telegram from J. B. John, president of the Medusa Portland Cement Co. and chairman of the association's accident prevention committee, who started in the cement industry in one of the Lehigh mills 32 years ago:

"Please accept heartiest congratulations and every good wish for the continuance of splendid safety record at your Birmingham mill. Our association and all mills throughout the country are proud of the stand you have taken and of the accomplishments of your organization down to the last man. MacFetridge and his assistants doing great work."

Colonel Young was followed by Dr. Thigpen, state commissioner of compensation for Alabama, who expressed the regrets of Gov. Bibb Graves, who was unable to attend. Commissioner Thigpen praised the accident prevention work going on in the cement mills of Alabama as most commendable from the standpoints both of humanitarianism and the avoidance of waste. Following his address, Colonel Reninger introduced Dr. James S. Thomas of the University of Alabama, who was the speaker of the day.

Barbeque Big Feature

Following the program, an elaborate barbeque lunch was served in the bag house and packing department. The large bag storage had been prepared for the occasion by decorating it with hundreds of evergreen branches from the surrounding hills. Long banquet tables had been arranged, tastily decorated with a variety of flowers. When 772 guests were seated at the tables the picture was one which presented perhaps the largest dinner party yet held in any cement mill. The splendid band from the Alabama Industrial Schol rendered music so stirring that those present could hardly remain in their seats. Finally, when "Dixie" was played the celebration was at its height as the entire assembly clapped and cheered.

Over in the sacking department nearly 200 colored workers and their families enjoyed a similar celebration at the same time. Eight hundred and fifty pounds of lamb and pork were provided, being prepared over charcoal fires in a large pit. The meal was put on at 5 o'clock in the morning by Capt. Jack Phillips, a prominent barbeque expert of Birmingham, with a crew of 20 helpers.

Later in the day Colonel Young and party visited points of interest around Birmingham and were the guests of Mr. and Mrs. R. H. MacFetridge at their suburban place.

The safety committee of the Birmingham plant for the year 1929 was as follows: R. H. MacFetridge, chairman; O. C. Brown, secretary; A. Carlson, A. Layton, R. E. Gudgen, C. E. Harris, C. D. Scott, John O'Brien, I. W. Cunnliff, Sr., W. A. Craig, W. H. Jones, J. L. Akins, W. G. Hayden, H. E. Scoggins and Dr. H. E. Pearce, plant physician.

Iola Celebrates Third Successive Year

At the Iola (Kansas) plant of the Lehigh company the celebration on Thursday, June 5, took the form of a general rejoicing over the completion of three calendar years without a lost-time injury. Colonel Young, who has not been in Iola for a number of years, was the guest of honor. Ever since the association trophy was first awarded to this mill, at the end of 1927, the community has taken a lively interest in safety work there and the rededication of the trophy on June 5 attracted a large number of townspeople in addition to the workmen and their families.

The formal ceremonies were opened at 2 p. m. with the superintendent, Charles A. Swiggett, presiding. The program was as follows:

"America," sung by all, accompanied by the Iola band.

Invocation by Rev. J. H Sowerby of Iola.

Quartet, the Lehigh Four—F. P. Hoover, George Busley, Earl Sparks, F. B. Fegeley, Virgil Kinnell, accompanist.

Rededication of the Portland Cement Association trophy by Ernest R. Rogers, district engineer, Portland Cement Association, Kansas City, Mo.

Response for the plant organization, Mr. Swiggett.

Ladies' quartet—Mrs. A. R. Enfield, Mrs. Ralph Stover, Mrs. L. L. Burt, Miss Viola Dalgarno, Mrs. J. E. Cornish, accompanist.

Address, Lt.-Col. H. A. Reninger, in charge of Lehigh safety and welfare work.

Address, Hon. Charles F. Scott, editor, *Iola Daily Register.*

Address, Col. E. M. Young, president, Lehigh Portland Cement Co., Allentown, Penn.

Benediction by Rev. J. Lee Releford of Iola.

The speech of E. R. Rogers, who rededicated the trophy as representative of the Portland Cement Association, was as follows:

"We are gathered here today to celebrate the accomplishment of over three years of operation by this plant without injury or loss of time to a single workman. With only one exception, your mill here in Iola has operated longer without lost-time accidents than any other in America. We are happy to know that the mill at Cowell, Calif., which was reported last year as having a perfect record a few months longer than the Iola mill, succeeded again in 1929 in avoiding an accident and we are informed that it has just completed four full years without a personal injury to an employe.

"It is our hope that the Iola mill will not only equal but will surpass any record which has been made up to this time and it is our firm belief that this is not only possible but very likely, considering your advantage of sympathetic management, intelligent supervision, well equipped mill and intelligent workmen. You have shown splendid teamwork and self-control.

"On behalf of the members of the Portland Cement Association and all of the cement mills of America, it is my privilege to extend hearty congratulations to each and every one of you on the occasion of the third dedication of your trophy. These congratulations go very properly to President Young of the Lehigh company and his official family, including Vice-President Ritter and Colonel Reninger, in charge of safety work. I might also appropriately include your division sales manager, T. F. Brown, who sells your safety made product for the construction of safe roads and firesafe buildings. He has shown constant interest in the accomplishments of your mill organization. Let me also congratulate Superintendent Swiggett, the safety committee and every employe of this plant and his family.

"You may feel proud of your mill and your achievement. You continue to provide

scores of other mills with an almost invaluable example. I am sure that this vicinity is proud of the fact that a local institution has contributed so much to prosperity and has been able to avoid so consistently any harm to its working force.

"The rededication of this trophy again signifies your leadership among cement mills and carries with it an even prouder honor than we were able to bestow a year ago."

After the ceremony picnic lunch was served under the supervision of the safety committee in the plant park. The 1929 safety committee membership was as follows:

A. A. Brune, secretary, safety committee; Lloyd Carter, safety engineer; Ben Chambers, shift foreman; J. E. Clark, packing foreman; M. H. Creviston, yard foreman; J. A. Fisher, quarry foreman; C. W. Gilbert, construction foreman; M. M. Kellenberger, shift foreman; C. E. Kietzman, chief electrician; W. B. Ledford, mill foreman; E. C. McCoy, storekeeper; R. E. McDonald, chief engineer; R. D. Moritz, repair foreman; J. B. Moyer, shift foreman; J. O. Myers, machine shop foreman; C. E. Russell, chief clerk; H. A. Snyder, beltman; J. G. Stadler, chemist; C. A. Swiggett, superintendent, and W. A. Woodruff, carpenter foreman.

Alpha Plant Celebrates Another Safe Year

Rededication of Trophy Is Big Event at Michigan Mill

ON THURSDAY, JUNE 5, the Bellevue, Mich., mill of the Alpha Portland Cement Co. celebrated the rededication of its Portland Cement Association trophy for a perfect safety record during 1929.

There were present a large number of distinguished guests including President G. S. Brown of the Alpha company, who was able to leave his headquarters in the East for a period barely long enough to participate in the ceremonies; C. A. Irvin of Chicago, vice-president of Alpha, and Mrs. Irvin; Henry McClarnan of Chicago, general superintendent; E. C. Hutchins of Coldwater, Mich., chief chemist of the Wolverine Portland Cement Co., and others.

Left to right, C. A. Irvin, vice-president of the Alpha company; G. A. Lawniczak, superintendent of the Bellevue plant, and G. S. Brown, president

After an invocation by Rev. Dr. Chase of Bellevue, greetings and congratulations on winning the association trophy for the second continuous year were brought by A. J. R. Curtis, who spoke on behalf of the Portland Cement Association and the other cement mill organizations throughout America. Telegrams were read from H. G. Jacobsen and J. B. John, the latter reading as follows:

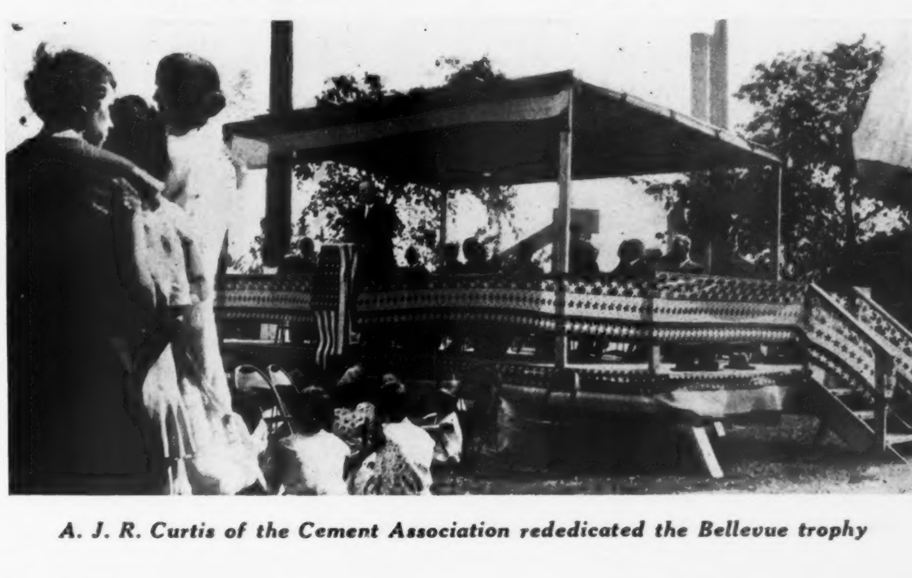
"Portland Cement Association and cement mills throughout America are proud of your safety record and on their behalf I send hearty congratulations and best wishes for your continued success. The stand taken by your company officers as well as by every workman deserves highest praise."—J. B. John.

Gilford Leeser, one of the delegates of the Bellevue mill to the meeting of the Cement Association in New York, responded on behalf of the mill organization. He was followed by President G. S Brown, who made an extremely interesting safety address. In tracing the progress of the Alpha mills in the reduction of accidents, Mr. Brown recalled how he was forced to look on with envious eye while mills of other companies carried off the trophies. He said that since his company had won its first trophy in 1927 improvement had been rapid.

During the period from January 1 to June 1, 1929, Mr. Brown stated that there had been 11 recordable accidents in the 10 Alpha mills, two of these mishaps proving fatal and nine involving loss of time. As an indication of progress Mr. Brown said that during the corresponding period in 1930 these mills had suffered but four lost-time accidents and no fatalities. He exhibited well justified pride, he said, because of progress made by the mills in reducing accidents. In contrast, Mr. Brown stated that he had asked his safety director to extend his work to the drivers of the company's 100 salesmen's cars, accidents among which have been numerous as compared with the mill record.

Hon. J. L. Boer of Lansing, secretary of the State Department of Labor and Industry, followed Mr. Brown with words of highest commendation for the humanitarian motives back of the accident prevention work in this and other cement plants. He told the assemblage that the cement mills were proving that, while competition might be the life of trade, competition certainly is the death of accidents. Other speakers were W. H. Jones, director of safety of the Canadian National Railways, Montreal; Vernon Sutton, safety director of the Kellogg Food Products Co. of Battle Creek, Mich., and Ross Farra, secretary-manager of the Grand Rapids, Mich., Safety Council.

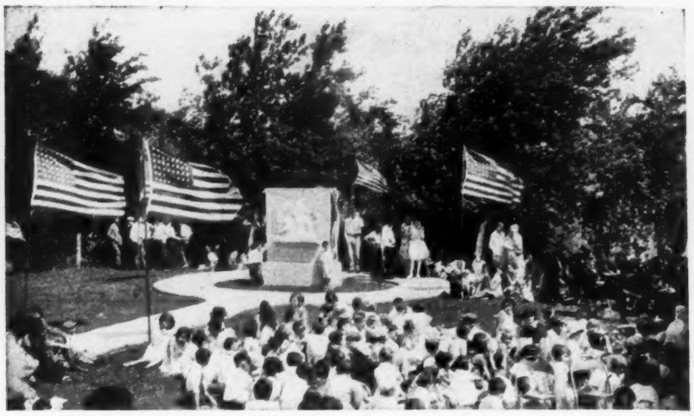
The school children of Bellevue marched to the celebration in a body, led by the Kellogg band of Battle Creek and a color guard of Bellevue Boy Scouts. The ceremonies were followed by a community picnic and jollification in the city park which included a schedule of athletic events and contests in which practically the entire city participated.



A. J. R. Curtis of the Cement Association rededicated the Bellevue trophy

Nazareth Division Safety Meeting

THE NAZARETH DIVISION of the Lehigh Valley Safety Council held the largest meeting in its history on May 22, when approximately 1,000 persons were in attendance. The meeting was held in the Broad Street Theatre under the auspices of the Nazareth Chamber of Commerce.



The picnic luncheon in the city park at Bellevue and, at the right, the children of Bellevue seated around the trophy which occupied the focal point of interest in the big rededication ceremony arranged by the Alpha Portland Cement Co., at its Bellevue, Mich., plant

The attendance represented a large majority of all the employes of all cement companies in and around the Borough of Nazareth, together with the Bates Valve Bag Co. The following organizations sponsored the meeting and attended in large numbers: Hercules Cement Corp., Nazareth Cement Co., Lone Star Cement Co., Keystone Cement Co., Penn-Dixie Cement Corp., Plants 4 and 6, Bates Valve Bag Co., Nazareth Public Schools, Chamber of Commerce and the Rotary Club.

The purpose of the meeting was to draw all organizations that are members of the National Safety Council into a semi-annual meeting, and to start off a Five-Month No-Accident Campaign in which the Hercules Cement Corp., Nazareth Cement Co., Lone Star Cement Co., Keystone Cement Co. and Penn-Dixie Cement Corp., Plants 4 and 6 compete for silver plaque trophies which will be awarded at the conclusion of the campaign. Splendid music was furnished by Dick Smith and His Troubadours. The Cement Choral Club sang a number of selections which were very much enjoyed by those in attendance. This is a choral club made up of representatives from the various cement companies.

Mr. Fred Hunt, electrical engineer of the Nazareth Cement Co., very ably acted as chairman of the meeting. He introduced Mr. R. B. Fortuin, assistant to the general manager of the Penn-Dixie Cement Corp., who outlined the purpose of the meeting and the procedure in the coming Five-Month No-Accident Campaign.

Mr. Fortuin stated that in 1927 the plants in the campaign experienced twenty lost-time accidents. The following year, which was the first campaign, resulted in but three lost-time accidents among all the competing plants. Three lost-time accidents were reported for the same period in 1929. The year 1930 holds excellent prospects of five months without a single lost-time accident.

The chairman then introduced Mr. N. P. Grady, foreman of the Canton, Ohio, shops of the Pennsylvania Railroad. Mr. Grady is a speaker with wide experience and one who enjoys talking to an audience receptive to safety ideas. The keynote of his talk was that a man, to be an efficient employe and one who is a safe employe to himself and his fellow-workers, requires three assets; they are personality, poise and tact.

Mr. Grady's points were so well presented that at the conclusion of his talk the entire audience were one in realizing that personality, poise and tact make the efficient and safe worker. Following Mr. Grady's talk the meeting was brought to a close in showing the all-talking Vitaphone picture, "Loose Ankles," starring Douglas Fairbanks, Jr.

The gathering was the largest and most enthusiastic, and most enjoyable held to this time in Nazareth. The sponsors feel well pleased with the meeting and are proud of the fact that this is the only one of its kind probably held in Pennsylvania. These meetings are a wonderful means of promoting good fellowship, co-ordination and co-operation in the great work of reducing accidents in industry and the community, and will be continued next fall.

Lehigh Valley Cement Mills Hold Greatest Safety Dinner

THE BANQUET SCENE SHOWN above was taken at the 14th annual safety meeting of the cement mills located in the Lehigh Valley of Pennsylvania, held under the auspices of the Portland Cement Association at Hotel Easton, Easton, Penn., on May 29. More than 300 officials and employes of these mills were present, and in point of numbers as well as general arrangements the dinner was the greatest held by the association mills to date. Fred B. Hunt, electrical engineer of the Nazareth Cement Co., acted as toastmaster; the principal speaker being Dr. Theodore J. Grayson, director of the school of commerce of the University of Pennsylvania.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Modernistic Trend in Designs on Cement Products

By George Rice
Palo Alto, Calif.

Part I—Certain Principles of Design Govern Artist's Interpretation

THE MODERNISTIC TREND in designs on cement tiles, flagstones, garden pottery, door stops, flower boxes and cement objects for general architectural use is somewhat different from what it was a few years ago.

The principles of pattern design have not changed very much in detail, but the application of those principles requires a different procedure, as all know who are familiar with the present status of art in the ceramic industry. The drastic changes which have taken place in the designs and textures of architectural terra cotta are typical of the changes which have developed in every line of rock products.

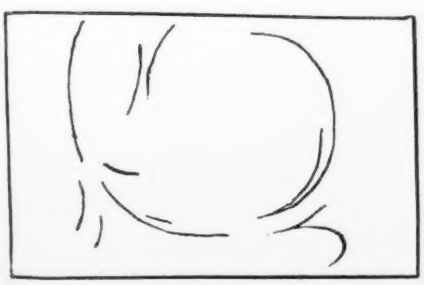


Fig. 1. The frame of the design is made with a few flourishes

What the future trend in designs is going to be cannot be stated with any degree of accuracy because of the stress the general public is placing upon the importance of pattern changes. A designer of cement products no sooner produces a fine line of ornamental patterns for the output of his plant than he may have to scrap them because of overnight fashion changes.

We have interviewed a number of manufacturers and designers of cement ware lately and also corresponded with others at a distance. One of the best designers we know states that the modern trend for decoration on cement objects is towards the simple conventional effects, yet the motifs in the patterns must be striking and attractive, rather than dull and uninteresting.

Ornamentation of this type is adaptable to the kind of home decorations now in use, and if used on tile about a fireplace the designs usually will harmonize with those of the upholstery and drapery of the room. But this same designer produces work for night clubs where nothing of the sombre, staid or conventional description is likely to fit in with the elaborate and intricate system of floor and wall artistry or the colorful illumination. Refreshing newness and sometimes glaring effects bordering on the incongruous in both design and color are required for the cement architectural displays in the night club salons.

Fig. 2. The motifs are then blocked in

Designs Based on Certain Principles of Construction

Some of the designs which appear on cement objects have been tediously created by experts who have sought to keep within sane bounds, yet they prove to be incapable of making the objects good sellers. In fact, one of the best sellers shown us by a ceramic designer of good standing was accidentally made in his studio by the slip of his brush on the preliminary canvas draft. We examined designs intended for garden pottery which were built up by combining a number of old designs and beautifying them with colors now in vogue.

Other designs appeared to be based upon ornamentation of the character used on stonework by the ancients. Others evidently were based more on plain lunacy on the part of someone, rather than on art. But all have their good features wherever made or where seen in use. Some may be jazzy, but jazz is popular now and often does more towards selling an article than the simple and subdued designs.

But whether the designs on the cement products are based on merit, or jazz, or just plain lunacy, there are certain essential principles to observe to make the articles worth while. There must be a degree of unity, symmetry, balance, measure, variety and radiation in any kind of design that appears on a cement surface, just the same as these elements must be present in design on wall paper, carpets, or dress fabrics. They have been in vogue a long time and will continue in use regardless of the variations which are made to make the designs conform to the requirements of the age.

Many years ago the writer studied design under Professor Charles Kastner, the German instructor in design in the Massachusetts Institute of Technology, and the above mentioned principles were pounded into every member of the class before we were permitted to do any actual designing. After qualifying, some of us were able to sell our designs to manufacturers long before finishing the course.

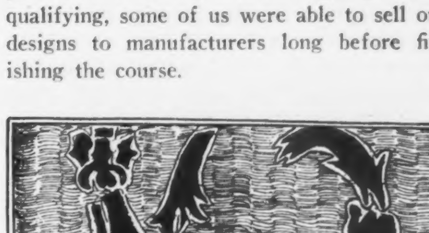


Fig. 3. Showing the finished design

Design Should Be Unified in Its Expression

Many an otherwise good design on a cement object has "blown up" because the element of unity has been overlooked. If a design is composed of an object selected from bird life, another from a geometrical form, another from something of a conventional order, and still another from out of practically nothing definite, there will be a mix up of motifs that may look good but will lack harmony of parts and will fail to pass the test of a properly constructed design. A good way to preserve unity in a design is to start off with the type of figurement which it is decided to use as the base or ground of the pattern.

We will take a subject of a naturalistic order, and produce the frame of the proposed design on the drafting paper or the drafting canvas as shown in Fig. 1. Then the motifs are blocked in as shown in Fig. 2. The finishing of the design is then accomplished by making the spaces between the sketch-lines solid as shown in Fig. 3. No motifs are inserted to disturb the unity element of the design.

If some geometrical figures were introduced in the spaces between the motifs already in position, there might be a more or less artistic touch developed, particularly if the added figures happen to warrant a lustrous color. But there would be danger of disturbing the unity of the design, and once this is disarranged the best of designs are liable to deteriorate in appearance, especially in the estimation of anyone who has an eye for art.

It is well to remember that no amount of filling in with additional motifs will help save a poor design, while sometimes the adding of them will impair the design which in its original state is at least good enough to make the object on which it appears salable. Symmetrical balance in cement designing will be considered in the next number of this series.

Ready-Mixed Concrete Producers to Meet in Pittsburgh July 10

J. E. BURKE, chairman, committee on organization, National Ready-Mixed Concrete Association, 545 Munsey building, Washington, D. C., has issued a general invitation to those interested to attend the final organization meeting of the new association at the William Penn Hotel, Pittsburgh, Penn., July 10, 10:30 a. m. The invitation has been issued to producers in both the United States and Canada. The invitation reads in part:

"It is understood that the term 'ready-mixed concrete' as used includes all commercially-produced concrete, whether made in a central mixing plant and conveyed to the place of deposit, or whether the materials are measured at a central proportioning plant and the mixing done in transit or at the place of deposit. In other words, the entire field of "ready-mixed-to-use-as-received-on-the-job concrete" is covered by the National Ready Mixed Concrete Association. This definition was formulated by the American Concrete Institute.

"While the subject of organization of our industry in order to stabilize and control its growth is one which all of us have discussed from time to time, no substantial progress in that direction was made until the National Sand and Gravel Association appointed a committee, consisting of ready-mixed concrete producers, to make a thorough study of the question and to determine what course should be followed in order to give full expression to the desires of those who compose the industry in the United States and Canada.

"It was at once evident that there was an overwhelming opinion in the ready-mixed concrete industry in favor of organization and co-operation. Therefore, the committee completed the duties entrusted to it by calling a meeting of the industry in Chicago on May 16.

"The attendance at the Chicago meeting was most gratifying. The discussions occupied the entire day and opportunity was given to all to give their views on the two questions which were submitted for decision: Should the ready-mixed concrete industry form an organization; and if so, what form should the organization take. The response to the first question was affirmative in every instance, and the temporary chairman then appointed a committee with instructions to draft a report on organization plans to be submitted to the meeting for approval. The members of this committee were as follows: R. B. Young, Ready-Mixed Concrete, Ltd., 159 Bay street, Toronto, Ontario, chairman; A. C. Avril, Avril Tru-Batch Concrete, Inc., Este avenue and B. and O. R. R., Cincinnati, Ohio; G. M. Bunn, Clinton Motors Corp., Reading, Penn.; J. C. Eakin, Big Rock Stone and Material Co., Little Rock, Ark.; E. F. Hill, Jr., Transit Mixers, Inc., Call building, San Francisco, Calif.; A. A. Levison, Blaw-Knox Co., Pittsburgh, Penn.; J. L. Shiely, J. L. Shiely Co., Inc., 210 Builders Exchange building, St. Paul, Minn.; H. F. Thomson, General Materials Co., Buder building, St. Louis, Mo.

Number of Contractors in Country Estimated at 100,000

APPROXIMATELY 175,000 report-blanks already have been distributed in the census of construction canvass and Dr. Alanson D. Morehouse, chief of the construction section, Distribution Division, Bureau of the Census, is of the opinion that the number of contractors and builders who did at least $25,000 worth of construction work last year will range from 75,000 to 100,000.

Undoubtedly questionnaires were sent to contractors who did not do that much business last year, and many contractors were missed, but all those errors will be eliminated by the personal canvass now under way. The construction census canvass was conducted entirely by mail until recently, when, in all cities of more than 10,000 population, it was turned over to the supervisors and enumerators for completion through personal visits.

Both general and subcontracting work are included in the census. The general contracting work includes such construction as building, highway, bridge and culvert, street paving, sewer, gas, water and conduit, dam and reservoir, waterworks, dredging, river and harbor, levees, railroads, foundation, power plants, and various other work, while subcontracting includes carpentering, concreting, electrical, elevator constructing, heating and piping, mason, painting and decorating, glass and glazing, pipe covering, plastering, plumbing, roofing, sheet metal work, steel erection, stone work, marble and tiling, wrecking, excavating, ornamental iron and various other similar work. For the purpose of this census, repair work and remodeling work are considered on the same basis as new construction, because such work utilizes construction materials and construction labor.

The number of report-blanks mailed to contractors in the various states follow: Alabama, 857; Arizona, 634; Arkansas, 791; California, 18,956; Colorado, 1704; Connecticut, 5318; Delaware, 373; District of Columbia, 1117; Florida, 2342; Georgia, 1014; Idaho, 325; Illinois, 10,550; Indiana, 4269; Iowa, 3322; Kansas, 1907; Kentucky, 1312; Louisiana, 1074; Maine, 1059; Maryland, 2674; Massachusetts, 9900; Michigan, 8030; Minnesota, 3808; Mississippi, 522; Missouri, 4226; Montana, 505; Nebraska, 1783; Nevada, 223; New Hampshire, 885; New Jersey, 8339; New Mexico, 243; New York, 26,919; North Carolina, 957; North Dakota, 665; Ohio, 10,380; Oklahoma, 1549; Oregon, 1423; Pennsylvania, 14,783 Rhode Island, 1463; South Carolina, 652; South Dakota, 597; Tennessee, 1677; Texas, 4995; Utah, 634; Vermont, 411; Virginia, 1504; Washington, 2095; West Virginia, 934; Wisconsin, 5807; Wyoming, 212.

William K. Newberry

WILLIAM K. NEWBERRY, assistant general manager of the Medusa Portland Cement Co., Cleveland, Ohio, died June 6. Mr. Newberry was graduated from the Sheffield Scientific School of Yale University with the class of 1889. For several years he was first assistant professor of chemistry at Cornell University. He left that position to go into the cement industry. At his death Mr. Newberry was one of the recognized authorities on the manufacture of cement.

Surviving are his widow, Mary Louise Van Winkle Newberry, and two sons, Roger and William.

Corona Quarry of Blue Diamond Co., California, to Be Reopened

WITH the construction of a rock crusher and loading facilities at the Blue Diamond rock crushing plant at Corona, Calif., which was practically destroyed by fire a few years ago, by Messrs. Kuster and Waterbury, shipping operations will start within a very short time. The local sand and gravel concern has extended its operations to the immense rock quarry of the Blue Diamond Co. through a special agreement of that concern. Workmen are busy with the installation, and orders for much material are already on hand.

Shipments will be made by truck and by the Santa Fe, which has a spur track into the quarry. The Corona concern will render a local service on materials as well as to Riverside county, which demands rock of this high quality in much of the road work. —*Corona* (Calif.) *Independent.*

Gold in Wisconsin Gravels—But Not in Paying Quantities

A RAIN of gold descended on sections of southeastern Wisconsin some 15,000,000 years ago.

And thereby hangs the tale of $33,000 worth of the precious ore mixed with the concrete of Milwaukee pavements.

This was revealed today by Thomas Rogers, chemist for Milwaukee's city engineering department, following a study of sand and gravel taken from Waukesha county pits.

"Although nowhere in this section have sufficient deposits of precious metals been found to make mining profitable, there are traces of gold, platinum and copper in sand through this section," Mr. Rogers said.

"The ores were apparently scattered along the beds of pre-glacial streams during the glacial age, and though scattered over large areas, the ore is found only in small quantities."

Pyrites, a glittering formation known as "fool's gold," is also found in large quantities in the state.

"Since it became generally known that the Waukesha gravel and sand pits contain about 3 cents in gold to the cubic yard, I have had a number of persons bring in 'nuggets' of this pyrites thinking they had made a valuable gold mine discovery," Mr. Rogers said.

Discovery of valuable gold deposits in this state is not impossible, but hardly likely, according to the chemist.

"There is no question but what gold is here, but it apparently 'rained' down on this section from the glaciers and deposits are very small," he said.

State Geologist E. F. Bean, Madison, has made no inspection of the Waukesha pits, but believes the possibility of discovering valuable deposits "highly unlikely," he told the *Wisconsin News.*

From the gold-bearing Waukesha pits is taken all the sand and gravel used in Milwaukee street paving projects. It is estimated that some $33,500 in gold has been imbedded with concrete in the construction of these streets.

"But don't try to dig them up," warned Chemist Rogers. "It really isn't quite worth it, as your earnings—unless police stopped you—would probably run less than 3 cents per week."

Des Moines Limestone Deposit to Be Developed

DEVELOPMENT of the Des Moines county, Iowa, land valued by the late Andrew Chezem for its mineral wealth at $35,000,000, is actually under way, according to W. S. Bashaw, who with others contesting Mr. Chezem's claim to the land, has been declared an owner of the property by a ruling handed down recently in Des Moines county district court at Burlington. The Chezum estate is said to have been denied an interest in the land.

Machinery worth about $20,000 was ordered this week and will be used in taking out the limestone, which is said to be of value for cosmetics, medicines and similar products. In rougher form it can be used in foundries and for fertilizer. Mr. Chezem's Limestone Fertilizer Co. is practically abolished by the court ruling against his estate, and the development is now in the hands of a firm to be known as the Calcite Products Co.—*Davenport* (Ia.) *Times.*

Greer Limestone Co. Moves

THE GREER LIMESTONE CO. has announced the removal of its sales offices from Morgantown, W. Va., to its plant at Greer. D. J. Kelly, who has been in charge of operations for a number of years, will also supervise the sales organization under the new arrangement, it was announced.—*Morgantown* (W. Va.) *Post.*

Illinois Gravel Deposit Near Ottawa to Be Developed

PROSPECTORS have uncovered and developed a vast gravel bed on the R. C. Iliff farm near Pleasant View college and gravel from that field is being used on some of the roads of La Salle county, Illinois.

The Ottawa Road Co. has taken a lease on the property and now has contracts in different townships for almost 100,000 cu. yd. of graveling. The new bed is said to produce exceptionally good gravel for road work, being mixed with an excellent clay binder, which prevents pitting by the fraction of automobile tires.

The principals in the company are B. J. Harrington and H. B. Smith, both of Marseilles.—*Ottawa* (Ill.) *Times.*

Fuller's Earth Production and Sales in 1929

THE FULLER'S EARTH sold or used by producers in the United States in 1929 amounted to 315,983 short tons, valued at $4,309,723, it is announced by the United States Bureau of Mines, Department of Commerce, which has collected statistics in co-operation with the Geological Surveys of Florida, Georgia, Illinois and Texas. This is an increase of 10% in quantity and value compared with 1928.

Every producing state except Nevada showed an increase in sales, and one state that reported for 1928—Arizona—reported none for 1929. The output was reported by 17 operators in 7 states in 1929, namely, Colorado, Florida, Georgia, Illinois, Massachusetts, Nevada and Texas.

Georgia was the leading state in production in 1929, with Florida second and Nevada third. These three states produced 78% of the total output. The average value per ton of fuller's earth was $13.64 in 1929, compared with $13.57 in 1928.

Fuller's earth is used almost exclusively in the bleaching or filtering of mineral and vegetable oils and animal fats, 99% of the domestic output being used for these purposes in 1929; the remainder was used as a filler, a binder, for fulling cloth, etc. Until 1895, when fuller's earth was successfully produced commercially in Florida, the United States was entirely dependent on foreign supplies. In 1929 the imports of fuller's earth were 8302 short tons, valued at $152,432, an increase of 9% in quantity and 15% in value compared with 1928.

The exports of fuller's earth are not separately shown in the official records of the foreign commerce of the United States, but seven producers reported to the Bureau of Mines that in 1929 they exported 21,264 short tons of fuller's earth, which was an increase of 29% over 1928.

Tennessee Contracts for Highway Cement

AN ALLEGED COMBINATION to maintain cement prices has been broken, according to a joint statement by the commissioner of finance, Charles M. McCabe, and the commissioner of highways, R. H. Baker, to the correspondent of the *United States Daily.*

After having rejected bids on approximately 1,000,000 bbl. of cement submitted by 11 firms at identical prices for various projects, the state has now purchased 62,400 bbl. at prices ranging from 20 to 25 cents per. bbl. less than those bids, the statement said.

The Marquette Portland Cement Co. of Memphis underbid the 11 other manufacturers, the commissioners said.

New Machinery and Equipment

Rotary Concrete Surfacer

THE CHICAGO PNEUMATIC TOOL CO., New York City, announces the CP No. 88 rotary concrete surfacer, adapted for finishing and smoothing concrete, finishing and polishing marble, granite and similar materials.

This tool employs the rotary principle, having a series of four vanes which rotate on a spindle in a casing having suitable openings for the admission and escape of compressed air. It is claimed that the efficiency of such a tool depends on even distribution of air upon the vanes, rather than upon the air pressure, and that the construction of this machine results in greater power than is possible otherwise and with less weight.

Rotary concrete surfacer

The surfacer is governor-controlled, has a removable air strainer, heavy-duty radial and thrust ball bearing on the wheel end, with renewable hardened rotor liner. The rotor is mounted on an over-capacity ball bearing, with an automatic oiler in the rotor housing and grease plugs in the handle and gear case ends.

The device rotates at 4250 r.p.m., is 21½ in. overall, and weighs 23 lb. net.

An Improved Type of Well Drill

TO OVERCOME some of the disadvantages said to exist in a structural-steel-framed well drill with wire rope cables, the Keystone Driller Co., Beaver Falls, Penn., has recently placed on the market an improved drill with dual rubber cushions located on an extension of the walking beams at the rear.

The accompanying illustration shows a No. 3½ well drill equipped with a 35-hp. cross-mounted, four-cylinder gasoline engine, rubber-tired road wheels and dual rubber cushion shock absorbers for operation with wire-rope cable. This machine is of wood frame construction. It has a depth capacity with manila cable of 400 ft.; with wire cable, of 800 ft. Equipped for quarry blasting, this machine would ordinarily be mounted on plain iron-tired wheels, or half crawler apron wheels. The other illustration shows a smaller and lighter machine, size No. 1½, of all-steel construction, equipped for use with manila cable. It also can be furnished with dual cushion shock absorbers when it is desired to operate it with wire cables. The No. 1½ is powered with a 20-hp. 4-cylinder cross-mounted gasoline engine, and will handle a 1600-lb. drill bit, it is claimed.

Both drills are said to have the same depth capacity, but the larger one will of course handle a heavier drill bit and drill more rapidly.

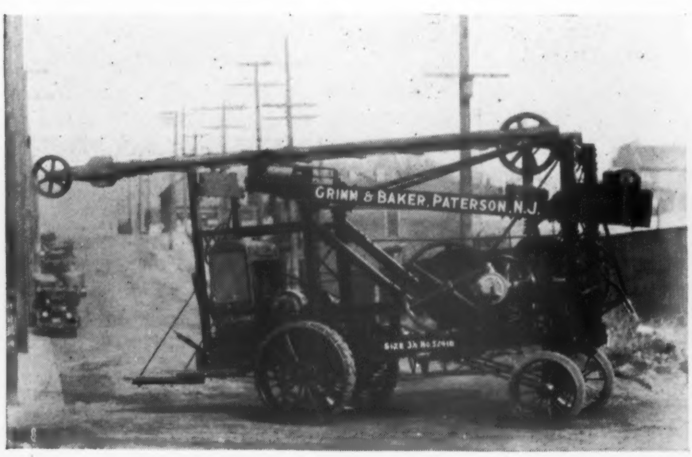
It is claimed that with the adoption of structural steel framing for well drills with wire-rope cable, drill manufacturers lost a considerable advantage in the resiliency found in wood-frame construction and manila-rope cable. Experienced well drillers for generations had been accustomed to drill on what they call "the spring of the cable," and have always believed, it is said, that this method of operation gave the maximum efficiency. With the adoption of wire rope, which has no stretch, and the use of steel-frame construction in the drill, the shock on the machinery of the drill was considerable, and it was to overcome these disadvantages, according to the Keystone Driller Co., that it built the type of drill illustrated.

Midget Roller Mill

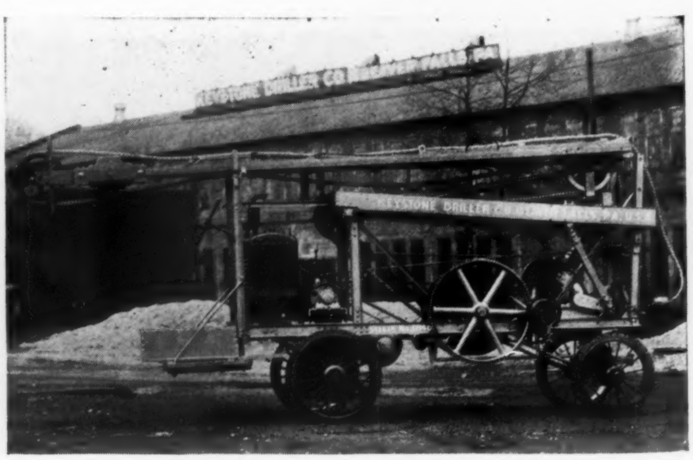
A NEW midget mill, designated as the No. 1 Roller Mill, and claimed to be particularly adaptable to the handling of limestone, talc and other nonmetallic minerals where small capacities, ranging from 500 lb. to 2000 lb. per hour are required, is announced by the Raymond Bros. Impact Pulverizer Co., Chicago, Ill.

Midget mill for handling limestone, talc and other materials

In cement plants, lime plants and power plants, where powdered coal is used, this



Well drill equipped with 35-hp. gasoline engine for use with wire rope cable



Smaller and lighter well drill, equipped for use with manila cable

small pulverizing unit can be used for direct firing furnaces, kilns and similar calcining or heating units. When grinding coal the capacity of the mill may be varied from as low as 1000 lb. to as high as 4000 lb. per hour, depending upon the fineness of grind and the physical characteristics of the coal, it is claimed.

The No. 1 roller mill, it is stated, may also be used as a kiln mill. Hot air or gases of combustion may be passed into the mill, making it possible to dry and pulverize in one operation.

The mill is constructed on the same principle as the larger Raymond roller mills. It is of the suspended roller type, in which the rolls are thrown out against the inside of a ring by centrifugal force, and grinding takes place between the rolls and ring. Plows are fitted ahead of each of the rolls to pick up material from the bottom of the mill and carry it to a point where it will be thrown between the rolls and ring. Three 6-in. face rolls operate against the ring, which is 30-in. inside diameter. The drive is through bevel gears and horizontal and vertical shafts, the gears operating in an oil-tight housing. A positive feed device is provided, and attached to this feed device is a pneumatic feed control, which automatically controls the flow of material to the mill, as it is being ground, maintaining a full load on the machine at all times. Journals are of the oil-lubrication type, and the air-separating equipment is of the same type as used in the larger mills, including a double-cone air separator, exhaust fan, cyclone collector, tubular collector and connecting piping.

Roller Sheaves

THE SULLIVAN MACHINERY CO., Chicago, Ill., has designed a new roller-bearing sheave or tail block for use in connection with scraper loading or slushing operations, to improve the character of slushing service rendered by its compressed air and electric portable hoists.

New roller bearing sheave for use with scraper loading operations

The new sheaves are built in 8-, 10- and 12-in. diameters, and are ruggedly constructed. The sheave itself is made of manganese steel, and the side plates are electric steel castings. The swivel hook is made of drop-forged, alloy steel, but a swivel eyebolt may be substituted for the hook if desired. The Hyatt roller bearing supporting the sheave revolves on a hardened steel shaft of large diameter, which is hollow and serves as a reservoir for lubricant. The sheave is recessed into the side plates, which the manufacturers state prevents the possibility of jamming as well as undue wear on the rope. Snatch block construction is employed in these sheaves, and the block may be easily opened by removing a pin. The opening for the rope at the top of the sheave, as shown in the accompanying illustration, will permit a square knot in the wire rope to pass through without binding. Lubrication is by means of improved grease gun fittings. Maximum capacities for these sheaves are as follows: the 8-in. sheave, 6,000 lb.; the 10-in., 10,000 lb.; and the 12-in., 140,000 lb.

New Steel Welding Rod

OXWELD ACETYLENE CO., New York City, has placed on the market a welding rod for making extremely strong welds in steel, designated Oxweld No. 22 S. D. (strength and ductility) steel welding rod. This welding rod has been developed especially to meet the demand for 100% joints in steel pipe having a carbon content of 0.30 to 0.40%, which has recently come into use. In general appearance, weldability, chemical and physical properties No. 22 S. D. rod is similar to the Oxweld No. 1 high test rod, but it will produce welds of even higher tensile strength, the manufacturers say. It is available in $\frac{3}{16}$-in. and $\frac{1}{4}$-in. diameters in 36-in. lengths.

Power Screen for Testing Coarse Materials

HENDRICK MFG. CO., Carbondale, Penn., announces a new power-operated testing screen, known as the Weston Screen, designed to meet requirements for testing of large samples of coarse aggregate. The manufacturers state that heretofore all testing of large samples of coarse aggregate has been done by hand, which is a very long and laborious operation, and that tests made with the Weston screen as compared with the old hand method, show the screen to be just as accurate as the hand method. In order to run a sample through this testing screen it is only necessary to run the screen from two to three minutes. The sieves can then be lifted off for inspection and weighing. Having each size of aggregate in a separate sieve allows the operator to make a visual inspection of each size.

The machine is rigidly constructed, the base being of welded steel plate construction with flanges for bolting to the floor or foundation. The two castings, the lower or supporting casting and the upper cone-shaped revolving castings are of gray cast iron, and are machined to fit closely within each other thus providing a tight seal for the driving mechanism. The driving mechanism consists of a worm and wheel, with the worm located

Power screen for testing large samples of coarse aggregate

in the lower casting, driven by a $\frac{1}{2}$-hp. motor through two V-groove pulleys and an endless V-belt. The worm shaft is provided with Timken roller bearings. The wheel is bolted to the upper casting.

Sieves are made of No. 18 gage steel with $\frac{1}{2}$-in. round steel hoops around the rim and the bottoms are beaded so that the sieves will rest snugly on each other. The bottom sieve rests on the cone-shaped casting, which is hollow in the center to allow the fines that pass through the bottom sieve to go through the casting and be caught in a container in the back of the machine. Sieves are 30 in. in diameter and the sides are $4\frac{1}{2}$ in. high. Any combination of size openings may be had from $\frac{1}{4}$ in. round or square up to the very large sizes. The bottoms are cone-shaped and each sieve weighs approximately 15 lb. when empty, will hold about 25 lb. of material, and can be easily handled by one man, it is claimed.

The standard machine is made to hold four sieves and an extension shell. When the sieves are in place the clamps are closed; the sieves are then held tightly in place, and the machine is ready for operation with the turning of the power switch. After running the sample through, the clamps are opened and the sieves taken off ready for inspection and weighing. The machine is furnished complete as shown in the illustration, ready to connect to the light or power circuit.

Moline (Ill.) Gravel Producers Sued by State

SUIT brought by the state of Illinois against Beder Wood's Sons Co. of Moline, Consumers Co. of Moline and the Builders' Sand and Gravel Co. of Davenport, Ia., became public recently when it was announced that service has been obtained on representatives of the three defendant companies.

The state's declaration, signed by Oscar E. Carlstrom as attorney general, Gov. Louis L. Emmerson and Harry H. Cleaveland, director of the department of public works and buildings, seeks an injunction against the companies from taking gravel from a pit along the river road known as Route 80 between Cordova and Albany and also seeks to recover \$17,000 alleged damages for gravel already taken from the pit, which is along the side of the road. The new chart on Route 80 places it between an eighth and a quarter mile away from the pits.—*Moline* (Ill.) *Dispatch.*

Moose River Basin Contains Large Gypsum Deposit

THE MOOSE RIVER BASIN in Ontario, Can., contains probably one of the largest gypsum deposits on the Canadian continent. A survey of this district, entitled "Geology and Economic Deposits of the Moose River Basin," has been issued by the Ontario Department of Mines and written by W. S. Dyer. According to the department, the mineral is of exceptionally good quality. It is usually granular or finely crystallized and snow white.

Two analyses from Moose River show: CaO 32.80, 32.90; SO_3 44.98, 45.98; H_2O 21.35, 21.01; MgO 0.70, none; Fe_2O_3-Al_2O_3 trace, trace; SiO_2 none, trace. The gypsum was formed by hydration of anhydrite. Three carbonaceous deposits are known: Mesozoic lignite, Pleistocene sand containing lignite boulders and Pleistocene interglacial peat.

Fire clay of first-class quality appears to be widespread. Physical tests on 33 samples showed 21 fusing above 1730 deg., eight between 1670 deg. and 1730 deg., and four non-refractory. Most samples burn to buff or gray. The clays are fine-grained, very plastic and easily worked. Boulder, marine and swamp clays, flood-plain silts and Devonian shales also are found. The marine clay has a high lime content and burns to a creamy colored, porous body. It can be used for building brick. The swamp clay can be used for red brick or drain tile. The silt is of value in making marine clay more easily workable and quicker drying.

Kaolin and silica sand also occur. Sand and gravel (glacial in origin) occur only in isolated patches. Pure limestones (95% $CaCO_3$) are common.

Iron ore occurs at the Grand rapids of the Mattagami river. It is essentially siderite, although limonite is occasionally present. The best ore analyses: Fe 43.52, SiO_2 5.40, Al_2O_3 2.63, S 0.74, P 0.08, H_2O 2.18 and CO_2 30.40%. The ore occurs in cracks and cavities in limestone. These openings were originally enlarged joint planes and pockets formed by solution of the limestone. Replacement was also active in forming this deposit.

Oklahoma Sand and Gravel Association Elects Officers

C. H. MAKINS, Oklahoma City, Okla., cement construction contractor, was elected president of the Oklahoma Sand and Gravel Association at its meeting recently.

Discussion of freight rates and of technical developments in construction occupied the greater part of the meeting. F. W. Peck, Kansas City, and R. J. Potts, president of the National Sand and Gravel Association, spoke.

Other officers elected: Fred Ratcliff, Tulsa, secretary-treasurer; and Ed O'Connor, Waynoka, and H. B. Barling, Muskogee, members of the executive committee.

Crushed-Stone Producer Adopts Aluminum-Body Trucks

THE MANEGOLD STONE CO. of Milwaukee, Wis., is now using motor trucks equipped with aluminum dump bodies, the company being the first in Wisconsin to use trucks so equipped. Weight of the chassis and body of the new type trucks totals 13,300 lb., as compared with 15,380 lb. for a truck with a steel body, the weight difference thus permitting the aluminum truck to carry an extra ton of pay load without exceeding the rated capacity. Manufacturers are satisfied with the practicability of aluminum bodies for heavy duty hauling.—*Manitowoc* (Wis.) *Herald-News.*

California Silica Development

REOPENING of the sand pits in the Mt. Diablo foothills between Brentwood and Byron is a development for the immediate future by the Silica Co. of California, according to announcement made recently.

The Silica Co., headed by R. M. Greathouse, recently acquired the sand pits, opened sometime ago by the Merrill interests and recently awarded contract to J. T. Lubbe of Martinez, Calif., for the building of the grade for a spur track connecting with the Southern Pacific main line east of Brentwood and extending to the sand pits, where extensive machinery will be installed for the mining of the sand, used in the blowing of glass bottles, in vast quantities.—*Martinez* (Calif.) *Gazette.*

Proceedings of Highway Engineering Conference

THE proceedings of the Sixteenth Annual Conference on Highway Engineering, held at the University of Michigan, Ann Arbor, on February 11 to 13, 1930, are now available in book form.

All the papers presented at the conference have been reprinted in the book, those of particular interest to ROCK PRODUCTS readers being one on "The Effect of Soft Particles of Coarse Aggregate on the Strength and Durability of Concrete," by W. J. Emmons, and "Concrete Pavement Maintenance" by E. J. Vaughn.

Copies may be obtained from the University of Michigan Press, Ann Arbor, Mich.

Universal-Atlas Cement Opens Offices in Newark, N. J.

A NEW JERSEY AGENCY for the Universal Atlas Cement Co., Chicago, Ill., subsidiary of the United States Steel Corp., was opened recently in the occupancy of a suite of offices on the 19th floor of the Lefcourt-Newark building, Newark, N. J. The New Jersey office is in charge of H. F. Van Wagner, sales manager for the New Jersey division, who has been with the company since 1917, and head of the division since 1921.

Estimating pH Values of Tobacco Soils to Lime Needs

FACTORS AFFECTING the estimation of lime requirements from pH values are described by M. F. Morgan in an article in *Soil Science.* A study was made, on tobacco soils of Connecticut, of the relationship of pH values of soils to their lime requirements and of the factors which affect the rate of change of pH values when lime is added to different kinds of soils.

The relationship between quantity of $CaCO_3$ added to an acid soil and the resulting pH value is calculated in terms of a "$CaCO_3$ absorption factor," which is found by dividing the average $CaCO_3$ requirement expressed in tons per 2,000,000 lb. of soil by the difference between pH 7 and the determined pH. The $CaCO_3$ absorption factor is equal to the moisture equivalent multiplied by 0.119.

For neutralization of an acid soil the $CaCO_3$ requirement in tons per 2,000,000 lb. of soil is the $CaCO_3$ absorption factor multiplied by (7 — pH). In case it is desired to bring a soil to pH 6 instead of pH 7, the factors can be diminished to approximately 80% of the above values. Soil texture and organic matter have a marked influence upon the $CaCO_3$ absorption factors. Clay and organic matter content each increases the value of this factor.

The Rock Products Market

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

R*OCK PRODUCTS *solicits volunteers to furnish accurate price quotations.

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, N. J.		.65	1.25	1.25	1.15	1.15
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.25	1.15	1.75		1.75	1.75
Buffalo, N. Y.	1.00	1.05	1.05	1.05	1.05	1.05
Erie, Penn.	.70	.95	1.40			
Machias Junction, N. Y.	.65	.65	.65		.65	.65
Milton, N. H.			1.75		1.25	1.00
Montoursville, Penn.	1.00	.70	.75	.50	.40	.40
Northern New Jersey	.30– .50	.30– .50	.90–1.25		.90–1.25	
South Portland, Me.		1.00	2.25	2.00	2.00	2.00
Georgetown, D. C.	.55	.55	1.00	1.00	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.60	.30	.30	.40	.40	.40
Appleton, Minn.		.50	1.25		1.50	
Attica, Ind.			All sizes .75–.85			
Barton, Wis.		.40	.50	.60	.60	.60
Cincinnati, Ohio	.55	.55	.80	.80	.80	.80
Crystal Lake, Ill.	.30	.15	.25	.30	.30	.40
Des Moines, Iowa	.40– .60	.60– .80	1.50–1.70	1.50–1.70	1.50–1.70	1.50–1.70
Eau Claire, Wis.	.40	.40	.55	.85	.85	
Elkhart Lake and Glenbeulah, Wis.	.50	.30	.50	.60	.50	.50
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio	.65– .75	65.– .75	.65– .75	.65– .75	.65– .75	.65– .75
Hersey, Mich.		.50			.70	.70
Humboldt, Iowa	.40– .50	.40– .50	1.10–1.30	1.10–1.30	1.10–1.30	1.10–1.30
Indianapolis, Ind.	.50.– .60	.25– .60	.40– .60	.45– .75	.45– .75	.45– .75
Kalamazoo, Mich.		.80	1.05	1.05	1.05	1.05
Kansas City, Mo.	.70	.70				
Mankato, Minn.	.55	.45	1.25	1.25	1.25	
Mason City, Iowa	.50	.50	.85	1.25	1.25	1.25
Milwaukee, Wis.		.86	.86	.96	.96	.96
Minneapolis, Minn.	.35	.35	1.25	1.35	1.35	1.25
St. Paul, Minn. (e)	.35	.35	1.25	1.25	1.25	1.25
Terre Haute, Ind.	.75	.60	.75	.75	.75	.75
Urbana, Ohio	.65	.55	.65	.65	.65	.65
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	.50	1.10	1.00	1.00
SOUTHERN:						
Brewster, Fla.	.40	.40				
Charleston, W. Va.	.70	1.25	1.25			
Eustis, Fla.		.40– .50				
Fort Worth, Texas	.75	.75	1.00	1.00	1.00	1.00
Knoxville, Tenn.	.60–1.00	.80–1.10			1.20	1.20
Roseland, La.	.20	.20	.70	.70	.60	
WESTERN:						
Los Angeles, Calif.	.10– .40	.10– .40	.20– .90	.50– .90	.50– .90	.50– .90
Oregon City, Ore.	3.00–3.50g	1.00–1.50	1.00–1.50	1.00–1.50	1.00–1.50	1.00–1.50
Phoenix, Ariz.	1.25*	1.15*	1.50*	1.15*	1.15*	1.00*
Pueblo, Colo.	.80	.60		1.20	1.20	1.15
Seattle, Wash.	1.00*	1.00*	1.00*	1.00*	1.00*	1.25*

*Cu. yd. ‡Delivered on job by truck. (e) Prices f.o.b. N. P. Ry.

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; per ton f.o.b. plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.00	2.00	2.25	1.50		4.00	
Cedarville, N. J.	Washed, 1.75 net ton; dried and washed, 2.25 net ton						
Cheshire, Mass.	Sand for soap, 7.00–8.00					6.00–8.00	
Columbus, Ohio	1.50	1.50	1.35	.90		3.50–4.50	
Eau Claire, Wis.						2.50–3.00	
Elco, Ill.	Soft amorphous silica, 92%–99% thru 325 mesh, 18.00–40.00 per ton						
Kasota, Minn.							1.00
Montoursville, Penn.				1.35–1.50			
New Lexington, Ohio	2.00	1.25					
Ohlton, Ohio	1.75*	1.75*		2.00*	1.75*	1.75*	
Ottawa, Ill.	1.25–3.25	2.25–3.50	1.25–3.25	1.25–3.25	1.25	3.50	3.50
Red Wing, Minn. (a)					1.50	3.00	1.50
San Francisco, Calif.	3.50†	5.00†	3.50†	2.50–3.50†	5.00†	3.50–5.00†	

†Fresh water washed, steam dried. *Damp. (a) Filter sand, 3.00.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		**1.50**
Eau Claire, Wis.	4.30	1.00
Montoursville, Penn.		1.00
Ohlton, Ohio	**1.75**	**1.75**
Ottawa, Ill.	**1.25–3.25**	**1.25**
Red Wing, Minn.		**1.00**
San Francisco, Calif.	3.50	3.50
Silica, Va.		**1.75**

Glass Sand

(Silica sand is quoted washed, dried and screened)

Cheshire, Mass., in carload lots	5.00–7.00
Klondike, Mo.	**2.00**
Ohlton, Ohio	**2.50**
Ottawa, Ill.	**1.25**
Red Wing, Minn.	**1.50**
San Francisco, Calif.	4.00–5.00
Silica and Mendota, Va.	**2.50–3.00**

Bank Run Sand and Gravel

Appleton, Minn.†	.55
Algonquin, Ill.¶ (½-in. and less)	.30
Brewster, Fla. (sand, ¼-in. and less)	.40– .50
Burnside, Conn. (sand, ¼-in. and less)	.75*
Chicago, Ill., and Grand Haven, Mich.†	.92–1.20
Crystal Lake, Ill.¶ (½-in. and less)	.25
Des Moines, Ia. (sand and gravel mix)	**.60–1.05**
Fort Worth, Tex.¶ (2-in. and less)	.65
Gainesville, Tex.¶ (1-in. and less)	.55
Gary and Miller, Ind.†	1.15–1.40a
Grand Rapids, Mich.¶ (1-in. and less.)	.55
Hamilton, Ohio¶ (1½-in. and less)	.50–1.00
Hersey, Mich.¶ (1-in. and less)	.50
Kalamazoo, Mich.	1.85b
Mankato, Minn.†	**.70**
Oregon City, Ore.—All sizes at bunkers	**1.00–1.50**
Pueblo, Colo.—†River run sand	**.50**
Winona, Minn.†	**.60**
York, Penn.—Sand, 1/10-in. down	1.10

***Cubic yard. †Fine sand. 1/-10-in. down. (a) Cu. yd., delivered Chicago. (b) 1½ cu. yd. ¶Gravel.**

Portland Cement

	F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.82½	3.30	4.30¶
Atlanta, Ga.		2.19†	3.49¶
Baltimore, Md.		2.26†	3.56¶
Berkeley, Calif.		**2.14**	
Birmingham, Ala		1.85†	3.15¶
Boston, Mass.	.47	1.88†	3.27¶
Buffalo, N. Y.	.51¼	2.05†	3.35¶
Butte, Mont.	**.90¼**	**3.61**	
Cedar Rapids, Ia.		2.23*	
Centerville, Calif.		**2.14**	
Charleston, S. C.		a2.29†	3.26¶
Cheyenne, Wyo.	.61½	2.46	
Chicago, Ill.		1.95*	3.25¶
Cincinnati, Ohio		2.14*	3.44¶
Cleveland, Ohio		2.04*	3.34¶
Columbus, Ohio		2.12†	3.47¶
Dallas, Texas		†1.90–2.20	3.49¶
Davenport, Iowa		2.14*	
Dayton, Ohio		2.14†	3.44¶
Denver, Colo.	.66¼	2.65	
Des Moines, Iowa	.48½	1.94	
Detroit, Mich.		1.95*	3.25¶
Duluth, Minn.		2.04*	
Fresno, Calif.		**2.33**	
Houston, Texas		†2.00–2.30	3.73¶
Indianapolis, Ind.	.54¾	1.99*	3.29¶
Jackson, Miss.		2.29†	3.59¶
Jacksonville, Fla.		b2.34†	3.26¶
Jersey City, N. J.		2.13†	3.43¶
Kansas City, Mo.	.50½	2.02	3.22¶
Los Angeles, Calif.	.43	1.72	
Louisville, Ky.	.55½	2.12–2.15†	3.42¶
Memphis, Tenn.		2.29†	3.59¶
Merced, Calif.		**2.01**	
Milwaukee, Wis.		2.10*	3.40¶
Minneapolis, Minn.		2.27*	
Montreal, Que.		1.60‖	
New Orleans, La.	.43	1.92†	3.22¶
New York, N. Y.	.50¾	2.03†	3.33¶
Norfolk, Va.		1.97†	3.27¶
Oklahoma City, Okla.	.61½	2.46	3.66¶
Omaha, Neb.	.59	2.36	3.56¶
Peoria, Ill.		2.12*	3.32¶
Pittsburgh, Penn.		1.95*	3.25¶
Philadelphia, Penn.		2.15†	3.45¶
Phoenix, Ariz.		**3.51**	
Portland, Ore.		†2.40–2.50‡	
Reno, Nev.		2.76‡	
Richmond, Va.		2.32†	3.62¶
Sacramento, Calif.		**2.25**	
Salt Lake City, Utah	**.70¾**	**2.81**	
San Antonio, Texas			**3.42¶**
San Francisco, Calif.		2.24‡	
Santa Cruz, Calif.		**2.10**	
Savannah, Ga.		a2.29†	3.16¶
St. Louis, Mo.	.48¾	1.95†	3.25¶
St. Paul, Minn.		2.27*	
Seattle, Wash.		1.75–1.90	†2.50c
Tampa, Fla.		2.00†	3.41¶
Toledo, Ohio		2.20*	3.50¶
Topeka, Kan.	.55¼	2.21	3.41¶
Tulsa, Okla.	.58¼	2.33	3.53¶
Wheeling, W. Va.		2.02†	3.32¶
Winston-Salem, N.C.		2.44†	3.54¶
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Albany, N. Y.		2.15	
Bellingham, Wash.		2.25	
Bonner Springs, Kan.		1.85	
Buffington, Ind.		1.70	
Chattanooga, Tenn.		2.05	
Concrete, Wash.		2.65	
Davenport, Calif.		2.05	
Hannibal, Mo.		1.80	
Hudson, N. Y.		1.85	
Independence, Kan.		1.85	
Leeds, Ala.		1.70	
Limedale, Ind.		1.70	
Lime & Oswego, Ore.		2.50	
Nazareth, Penn.		2.15	
Northampton, Penn.		1.75	
Richard City, Tenn.		2.05	
Steelton, Minn.		1.85	
Toledo, Ohio		2.20	
Universal, Penn.		1.70	
Waco, Tex.		1.85	

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. *Includes dealer and cash discounts. †Includes 10c cash discount. ‡Subject to 2% cash discount. (a) 44c refund for paid freight bill. (b) 38c bbl. refund for paid freight bill. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. ‖Includes sales tax. (c) Quick-hardening "Velo."

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chazy, N. Y.	.75	1.60	1.60	1.30	1.30	1.30
Farmington, Conn.		1.30	1.10	1.00	1.00	
Ft. Spring, W. Va.	.35	1.35	1.35	1.25	1.15	1.00
Jamesville, N. Y.	1.00	1.00	1.00	1.00	1.00	1.00
Oriskany Falls, N. Y.	.50–1.00	1.00–1.35	1.00–1.35	1.00–1.35	1.00–1.35	1.00–3.00
Prospect Junction, N. Y.	.50–.80	1.15u	1.15	1.10	1.10	1.10
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
Hillsville, Penn.	.85	1.35	1.35	1.35	1.35	1.35
Shaw's Junction, Penn. (e)	.85	1.20–1.35	1.20–1.35	1.20–1.35	1.40	1.30–1.35
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill. (b)	2.00		2.00			
Afton, Mich.				.25	.50–.75	1.50
Cypress, Ill.	.90	.90	.90	.90	1.00	1.15
Davenport, Iowa	1.20	1.50	1.50	1.30	1.30	1.30
Dubuque, Iowa	1.00	1.10	1.10	1.10	1.10	
Dundas, Ont.	.50	.80	.80	.70	.70	
Stolle and Falling Springs, Ill.	1.05–1.70	.95–1.70	1.15–1.70	1.05–1.70	1.05–1.70	
Greencastle, Ind.	1.25	1.10	1.10	1.00	1.00	1.00
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
McCook, Ill.	.80	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.75–1.00	1.65–1.85	1.45	1.15	1.05	.95
Sheboygan, Wis.	1.00	1.00	1.00	1.00	1.00	1.00
Stone City, Iowa	.75		1.10	1.00	1.00	1.00h
Toledo, Ohio	1.60	1.70		1.60		1.60
Toronto, Canada	2.50	3.00	2.50	2.50	2.50	2.50
Waukesha, Wis.		.90	.90	.90	.90	.90
Wisconsin points	.50		1.00	.90	.90	
SOUTHERN:						
Cartersville, Ga.	1.00	1.50	1.50	1.25	1.00	1.00
Chico and Bridgeport, Texas	1.00	1.15	1.20	1.15	1.00	1.00
Cutler, Fla.	.50r	1.75r	1.75r	1.75r	1.75r	1.50r
El Paso, Texas (v)	.50	1.25	1.25	1.00	1.00	1.00
Graystone, Ala.	Crusher run stone 1.00 per net ton					
Olive Hill, Ky.	.50–1.00	1.00	1.00	.90	.90	.90
Rocky Point, Va.	.50–.75	1.40–1.60	1.30–1.40	1.15–1.40	1.10–1.20	1.00–1.05
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.70
Blue Springs and Wymore, Neb. (t)	.25	.25	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.00	1.25	1.00	1.00	1.00	
Richmond, Calif.	.75		1.00	1.00	1.00	
Rock Hill, St. Louis Co., Mo.	1.30–1.40	1.30–1.40	1.10–1.40	1.30–1.40	1.30–1.40	1.30–1.40
Stringtown, Okla.	1.00	1.15	1.20	1.15	1.00	1.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35		1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	
Farmington, Conn.	1.00	1.30	1.30	1.00	1.00	
Duluth, Minn.	1.00	2.25	1.75	1.65	1.35	1.25
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	1.15	1.25	1.50	1.30	1.15	1.10
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	
Northern New Jersey		2.10	1.60–1.90	1.40–1.50	1.40–1.50	
Richmond, Calif.	.50		1.00	1.00	1.00	
Toronto, Canada	4.70	5.80	4.05	4.05	4.05	
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Cayce, S. C.—Granite			1.60	1.60	1.50	
Chicago, Ill.—Granite	2.00	1.70		1.50	1.50	
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.—Granite	.50	1.75	1.50	1.25	1.25	
Lohrville, Wis.—Granite	1.80	1.60		1.50	1.50	
Middlebrook, Mo.—Granite	3.00–3.50		2.00–2.25	2.00–2.25		1.25–3.00
Toccoa, Ga.—Granite	.50	1.35	1.35	1.25	1.25	1.20

(b) Wagonloads. (c) 1 in., 1.40. (d) 2-in., 1.30. (e) Price net after 10c discount deducted. (h) Rip rap. (n) Ballast, R. R., .90; run of crusher, 1.00. (q) Crusher run, 1.40; ¼-in. granlithic finish, 3.00. (r) Cu. yd. (t) Rip rap, 1.20–1.40 per ton. (u) ⅝-in. and less. (v) Roofing stone, 1.50 per ton.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Allentown, Penn.	1.00–1.50	.40–.60	.80–1.00	.50–.80	.50–.80	.60–.80	.80
Bethlehem, Penn.	1.25–1.75	.50–.70	1.00–1.25	.60–.80	.70–.80	.70–.90	.90
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Hokendauqua, Penn.	1.50	.70	1.00	1.15	1.15	1.15	1.15
Reading, Penn.	2.00	1.00		1.00			
Swedeland, Penn.	1.50–2.50	.60–1.10	1.00–1.25	.90–1.25	.90–1.25	1.25	1.25
Western Pennsylvania	2.00	1.25	1.25	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio		1.30*	1.80*	1.45*	1.45*	1.45*	1.45*
Jackson, Ohio		.65*	1.80*	1.30*	1.30*	1.30*	1.30*
Toledo, Ohio	1.50	1.10	1.35	1.35	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.		1.05*	1.80*	1.45*	1.45*	1.45*	1.45*
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.80
Longdale, Va.	2.50	.75	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05	.55*		1.15*	.90*	.90*	

5c per ton discount on terms. †1¼ in. to ¼ in., 1.05; ⅝ in. to 10 mesh, 1.25*; ⅝ in. to 0 in., 90*; ¼ in. to 10 mesh, .80*.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 99% $CaCO_3$; 0.3% $MgCO_3$, 90% thru 100 mesh	4.50
Belfast, Me.—Analysis, $CaCO_3$, 90.4%; $MgCO_3$, trace; 90% thru 100 mesh, per ton	10.00
Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh	1.50
Cartersville, Ga.	2.00
Davenport, Iowa—Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, per ton	6.00
Gibsonburg, Ohio—Bulk, 2.25; in bags	3.70
Hillsville, Penn.	2.10–4.50
Jamesville, N. Y.—Bulk, 3.50; in 80-lb. bags	4.75
Joliet, Ill.—Analysis, 50% $CaCO_3$; 44% $MgCO_3$; 90% thru 200 mesh	3.50
Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, bags, 3.75; bulk	2.50
Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton	2.00
Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh	4.25
Olive Hill, Ky., per ton	1.00
West Rutland, Vt.—Analysis, 96.5% $CaCO_3$; 1% $MgCO_3$, in 100-lb. burlap bags, per ton	4.50

Agricultural Limestone

(Crushed)

Bedford, Ind.—Analysis, 98% $CaCO_3$; 1% $MgCO_3$; 90% thru 10 mesh; 30% thru 100 mesh	1.50
Cartersville, Ga.—50% thru 50 mesh	1.50
Chico and Bridgeport, Texas—Analysis, 95% $CaCO_3$; 1.3% $MgCO_3$; 50% thru 50 mesh	1.00
Colton, Calif.—Analysis, 95-97% $CaCO_3$; 1.31% $MgCO_3$, all thru 14 mesh down to powder	3.50
Cypress, Ill.—Analysis, 96% $CaCO_3$; 90% thru 100 mesh, 1.25; 50% thru 100 mesh, 1.25; 90% thru 50 mesh, 1.25; 50% thru 50 mesh, 1.15; 90% thru 4 mesh, 1.25, and 50% thru 4 mesh	1.15
Davenport, Iowa—Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 4 mesh, 50% thru 20 mesh; bulk, per ton	1.20
Dubuque, Ia.—Analysis, 64.04% $CaCO_3$; 29.54% $MgCO_3$; 50% thru 50 mesh	1.00
Dundas, Ont.—Per ton	1.00
Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh; bulk, per ton	1.15–1.50
Gibsonburg, Ohio—90% thru 10 mesh	1.00–1.50
Hillsville, Penn.—90% thru 100 mesh, 50% thru 100 mesh and 90% thru 50 mesh	1.00–4.50
Lannon, Wis.—Analysis, 54% $CaCO_3$ 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio—90% thru 100 mesh	3.00
90% thru 50 mesh	2.00
90% thru 4 mesh	1.00
McCook and Gary, Ill.—Analysis, 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh	.80
Osborne, Penn.—50% thru 100 mesh	3.50–5.00
Rocky Point, Va.—50% thru 200 mesh, bulk, in carloads, 2.00; 100-lb. paper bags, 3.25; 200-lb. burlap bags	3.50
Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh	1.15–1.70
Stone City, Iowa—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
West Stockbridge, Mass.*—Analysis, 95% $CaCO_3$; 90% thru 100 mesh, bulk	3.50
100-lb. paper bags, 4.75; 100-lb., cloth	5.25
Waukesha, Wis.—90% thru 100 mesh, 4.00; 50% thru 100 mesh	2.10

*Less 25c cash 15 days.

Pulverized Limestone for Coal Operators

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton	6.00
Hillsville, Penn., sacks, 5.10; bulk	3.50
Joliet, Ill.—Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh (bags extra)	3.50
Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk	2.25–3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.00

Lime Products

(Carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime In bulk	Lump lime In bbl.
EASTERN:								
Berkeley, R. I.	....	....	11.40	....	....	17.50	....	20.65
Knickerbocker, Devault and Rambo, Penn.*	....	9.50	9.50	9.50	8.00	9.50	8.50	....
Lime Ridge, Penn.	....	....	8.75	....	6.50	8.00[3]	5.00	....
CENTRAL:								
Afton, Mich.	....	....	....	....	....	10.00	6.50	....
Carey, Ohio	9.50	6.50	6.50	....	8.00	....	8.00	....
Cold Springs, Ohio	....	7.75	7.75	....	....	....	7.00	....
Gibsonburg, Ohio	10.50	....	....	....	7.00	9.00[9]	7.50	....
Little Rock, Ark.	....	14.40	....	14.40	....	....	11.90	....
Luckey, Ohio*	10.50	7.75	7.75	....	....	....	7.00	....
Marblehead, Gibsonburg, Marion, Sandusky, Tiffin and White Rock, Ohio	10.50	7.75	7.75	11.00	7.00	9.00	7.00	....
Milltown, Ind.	....	9.00	8.25	9.50	7.50	....	7.00	....
Scioto, Ohio	9.75–10.50	6.00– 7.50	6.00– 7.50	7.00– 7.50	....	....	6.00	....
Sheboygan, Wis.	....	10.50	10.50	....	....	....	9.50	9.50
Wisconsin points	....	11.50	....	....	....	....	9.50	....
Woodville, Ohio	10.50	7.75	7.75	11.50[24]	7.00	9.00[9]	7.00	11.50‖
SOUTHERN:								
Cartersville, Ga.	....	9.00	....	....	....	13.50	....	15.00
Graystone, Ala.*	12.50	9.00	....	12.50	....	....	7.50	....
Keystone, Ala.	17.00	9.00	....	7.00– 9.00	....	....	5.00a	14.85
Knoxville, Tenn.	10.50	7.00– 9.00	7.00– 9.00	7.00	....	....	4.75‡	10.50¶
Ocala, Fla.	....	11.00	....	....	....	....	....	....
Pine Hill, Ky.	....	9.00	8.00	9.00	....	....	....	12.50
WESTERN:								
Colton, Calif.	....	....	....	....	9.50[4]	....	....	....
Kirtland, N. M.	....	....	....	....	....	....	15.00	20.00
Los Angeles, Calif.	....	....	....	....	....	....	12.00	....
San Francisco, Calif.†	16.00	14.00	6.00–12.00	14.00–19.00	14.50[20]	....	11.00[19]	....
San Francisco, Calif.	19.00	14.00–17.00	12.50	14.00–19.00	14.50[20]	....	11.00[19]	....

[1]Also 6.00. [2]To 1.35. [3]In 100-lb. bags. [4]To 11.85 per ton, granular but not ground, ¾-in. screen down to 14 mesh. [9]In 80-lb. paper. [10]Per bbl. [11]In wood; in steel, 11.60. [17]Less credit for return of empties. [19]To 14.50. [20]Also 13.00. [24]Superfine, 92.25% thru 200 mesh. *Price to dealers. †Wood-burnt lime: finishing hydrate 20.00 per ton, pulv. lime 2.00 per iron drum. Oil-burnt pulv. lime, 13.00–14.50 per ton. ‡To 6.00. ¶To 13.50. (a) To 8.50.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 100% thru 200 mesh, 7.00 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton. Granville, N. Y.—Red, green and black, $7.50 per ton.
Pen Argyl, Penn.—Blue-grey, 6.50 per ton in bulk, plus 10c per bag.

Roofing Slate

Prices per square—Standard thickness.

City or shipping point:	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—						
Buckingham oxford grey	13.88	17.22	24.99	29.44	34.44	45.55
Bangor, Penn.—No. 1 clear	10.00–14.00	20.00	25.00	29.00	40.00	50.00
No. 1 ribbon	9.00–10.25	16.00	20.00	25.00	35.00	46.00
Gen. Bangor No. 2 ribbon	6.75– 7.25	....	....	....	....	....
No. 1 Albion	7.25–10.50	16.00	23.00	27.00	37.00	46.00
Chapman Quarries, Penn.	7.75–11.25	13.00–15.00	19.00–22.00	23.00–28.00	27.00–30.00	32.00–35.00
Granville, N. Y.—						
Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green & gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple & unfading gr'n	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Monson, Maine	19.80	24.00	....	....	....	....
Pen Argyl, Penn.*						
Graduated slate (blue)	....	16.00	23.00	27.00	37.00	46.00
Graduated slate (grey)	....	18.00	25.00	29.00	39.00	48.00
Color-tone	11.50–12.50; Vari-tone, 12.00–13.00; Cathedral gray, 14.00–15.00					
No. 1 clear (smooth text)	7.25–10.50; No. 1 clear (rough text), 8:25–9.50					
Albion-Bangor medium	8.00–9.00; No. 2 clear, 8.00–9.00; No. 1 ribbon, 8.00–8.50					
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1 clear	9.50	18.00	22.00	26.00	36.00	46.00
Blue Mountain No. 2 clear	8.00	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.
*Unfading grey, 14.00–15.00; 10% disc. to roofer; 10%–8⅓% to wholesaler.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chatsworth, Ga.:
- Crude talc, per ton 5.00
- Ground talc (20-50 mesh), bags 6.50
- Ground talc (150-200 mesh), bags 9.00
- Pencils and steel crayons, gross 1.50– 2.00

Chester, Vt.—Finely ground talc (carloads), Grade A—99-99¾% thru 200 mesh, 8.00–8.50; Grade B, 97-98% thru 200 mesh 7.50– 8.00
1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of bags. Terms 1%, 10 days.

Clifton, Va.:
- Crude talc, per ton 4.00
- Ground talc (150-200 mesh), in bags 12.00

Conowingo, Md.:
- Crude talc, bulk 4.00
- Ground talc (150-200 mesh), in bags 14.00
- Cubes, blanks, per lb. .... .10

Emeryville, N. Y.:
- Ground Talc (200 mesh), bags 13.75
- Ground talc (325 mesh), bags 14.75

Hailesboro, N. Y.:
- Ground talc (300-350 mesh) in 200-lb. bags 15.50–20.00

Henry, Va:.
- Crude (mine run), bulk 3.50– 4.25
- Ground talc (150-200 mesh), bags 6.25– 9.75

Joliet, Ill.:
- Ground talc (200 mesh) in bags:
- California white 30.00
- Southern white 20.00
- Illinois talc 10.00

Los Angeles, Calif.:
- Ground talc (150-200 mesh), in bags 14.00–25.00

Natural Bridge, N. Y.:
- Ground talc (325 mesh), bags 10.00–15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70% 3.50–4.00
Mt. Pleasant, Tenn.—B.P.L. 76-78% 6.75

Ground Rock

(2000 lb.)

Gordonsburg, Tenn.—B.P.L. 65–70% 3.75– 4.30
Mt. Pleasant, Tenn. — Lime phosphate: B.P.L. 73.25% 11.80
Mt. Pleasant, Tenn.—B.P.L., 72% 5.00– 5.50

Florida Phosphate

(Raw Land Pebble)

(Per Ton)

Mulberry, Fla.—Gross ton, f.o.b. mines
- 68/66% B.P.L. 3.15
- 70% minimum B.P.L. 3.75
- 72% minimum B.P.L. 4.25
- 75/74% B.P.L. 5.25
- 77/76% B.P.L. 6.25

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton 100.00–125.00
- Punch mica, per lb. .... .06
- Scrap, per ton, carloads 20.00

Rumney Depot, Bristol and Cardigan, N. H.—Per ton:
- Punch mica, per ton 150.00–240.00
- Mine scrap 22.50
- Mine run 325.00
- Clean shop scrap 25.00
- Roofing mica 37.50
- Trimmed mica, per ton, 20 mesh, 37.50; 40 mesh, 40.00; 60 mesh, 40.00; 100 mesh, 45.00; 200 mesh 60.00

Spruce Pine, N. C.—Mine scrap, per ton 20.00

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x36". Per M Sq. Ft.	⅜x32x36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
Acme, Tex.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Blue Rapids, Kan.	1.50–3.00	4.00	4.00	4.00–6.00	4.00–6.00	4.00–6.00	10.00	10.00	19.00	19.00	10.50	10.50	12.00
Centerville, Iowa	....	....	6.00	7.00	....	7.50	8.50	10.50a	....	....	....	....	....
East St. Louis, Ill.—Special	Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton, floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 6 in. long, 17c per ft., 23.00 per ton.												
Fort Dodge, Iowa	2.50	6.00	6.00	7.00	9.00	9.00	11.50	8.00	16.00	20.00	15.00	....	25.00
Grand Rapids, Mich. (h)	....	....	7.00	9.00	9.00d	9.50d	19.50	8.00d	26.00	20.00d	....	....	25.00
Los Angeles, Calif. (b)	....	7.00–9.00	7.00–9.00	7.50–9.00	8.00–10.00	....	8.00–10.00	....	30.00c	....	....	....	....
Medicine Lodge, Kan.	1.40	....	....	....	....	....	11.50d	....	16.00d	....	....	....	....
Oakfield, N. Y.	3.00	....	....	6.00	9.00d	9.00d	....	6.00	....	....	....	....	....
Port Clinton, Ohio	3.00	4.00	6.00	9.00	9.00	9.00	20.00	8.00	25.50	20.00i	....	15.00	25.00
Portland, Colo.	....	7.00	7.00	9.00	9.00	9.50	9.00	....	27.50	....	22.50	27.50	....
Providence, R. I. (x)	....	....	....	12.00–13.00e	....	....	....	....	....	....	....	....	....
Seattle, Wash. (z)	6.00	9.00	9.00	13.00	....	....	14.00	....	....	....	....	....	....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	....	....	....	....	20.00	25.00g	33.00f

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) White molding. (b) Plasterboard, ¼x32x36-in., 14c-17c per sq. ft.; ⅜x32x36-in., 15c-18c per sq. ft. (c) To 40.00. (d) Includes paper bags. (e) Includes jute sacks. (f) "Gyproc," ⅜x48-in. by 5 and 10 ft. long. (g) ⅜x48-by 3 to 4 ft. long. (h) Gypsum lath, per M sq. ft., 15.00. (i) To 26.00. (x) "Fabricaste" gypsum blocks, 2- and 3-in., f.o.b. motor trucks at plant, 7¼c-8¾c. Block setting plaster, per ton, in jute sacks, 12.00. (y) Jute sacks, 18.00; paper sacks, 16.00. (z) Gypsum partition tile, 3-in., 9c per sq. ft.; 4-in., 11c per sq. ft.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	¶12.50–‖14.50	¶12.50–‖14.50
Cranberry Creek, N. Y.—Bio-Spar, per ton in bags in carload lots, 9.00; less than carload lots, 12.00 per ton in bags, bulk, per ton	....	7.50
Crown Point, N. Y.—Mica Spar	....	¶9.00–‖12.00
Davenport, Iowa — White limestone, in bags, per ton	‖6.00	‖6.00
Harrisonburg, Va.	12.50–14.50	....
Middlebrook, Mo.—Red	....	20.00–25.00
Middlebury, Vt.—Middlebury white	....	¶9.00–‖10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags	....	c5.50
Phillipsburg, N. J.	....	15.00–18.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Tuckahoe, N. Y.—Tuckahoe white	7.00	....
Warren, N. H. (d)	....	¶8.00– 8.50
Whitestone, Ga.	....	10.00

¶C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb. (c) Per ton f.o.b. quarry in carloads; 7.00 per ton L.C.L. (d) L.C.L., 9.50–15.00 ton in 100-lb. bags.

Soda Feldspar

De Kalb Jct., N. Y.—Color, white; pulverized (bags extra, burlap 2.00 per ton, paper 1.20 per ton); 99% thru 140 mesh, 16.00; 99% thru 200 mesh, per ton 18.00

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140 mesh (bulk)	19.00
Keystone, S. D.—Color, white; analysis, K_2O, 13.25%; Na_2O, 2.10%; SiO_2, 64%; Fe_2O_3, .03%; Al_2O_3, 20%, pulverized, 99% thru 200 mesh, in bags, 15.00; bulk	15.00
Crude, in bags, 9.00; bulk	8.00
Coatesville, Penn.—Color, white; analysis, K_2O, 12.30%; Na_2O, 2.86%; SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; crude, per ton	8.00
Erwin, Tenn.—White; analysis, K_2O, 10%; Na_2O, 2.75%; SiO_2, 68.25%; Fe_2O_3, .10%; Al_2O_3, 18.25%, pulverized 98% thru 200 mesh, in bags, 17.20; bulk	16.00
Crude, in bags, 8.50; bulk	7.50
Rumney and Cardigan, N. H. — Color, white; analysis, K_2O, 9-12%! Na_2O, trace; SiO_2, 64-67%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Rumney Depot, N. H.—Color, white; analysis, K_2O, 8-13%; Na_2O, 1-1½%; SiO_2, 62-68%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; pulverized, bulk (bags, 15c extra)	18.00

Cement Drain Tile

Graettinger, Iowa. — Drain tile, per foot: 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in., .35; 18-in., .50; 20-in., .60; 24-in., 1.00; 30-in. 1.35; 36-in. 2.00

Grand Rapids, Mich.—Drain tile, per 1000 ft.	
4-in.	36.00
5-in.	48.00
6-in.	66.00
8-in.	100.00
10-in.	150.00
12-in.	210.00
Longview, Wash.—Drain tile, per 100 ft.	
3-in.	5.00
4-in.	6.00
6-in.	10.00
8-in.	15.00
Tacoma, Wash.—Drain tile, per 100 ft.	
3-in.	4.00
4-in.	5.00
6-in.	7.50
8-in.	12.00

Chicken Grits

Centerville, Iowa	9.25
Cypress, Ill.—(Agstone)	1.15
Belfast, Me.—(Agstone), per ton, in carloads	10.00
Chico, Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per 100-lb. sack	1.50
Coatesville, Penn.—(Feldspar), per ton, in bags of 100 lb. each	8.00
Cranberry Creek, N. Y.—Per ton, in carload lots, in bags, 9.00; bulk, 7.50. Less than carload lots, in bags	12.00
Davenport, Iowa — High calcium carbonate limestone, in bags L.C.L., per ton	6.00
El Paso, Texas—(Limestone) per 100-lb. sack	.75
Los Angeles, Calif.—Per ton, including sacks: Gypsum	7.50 –9.50
Middlebury, Vt.—Per ton (a)	10.00
Randville, Mich.—(Marble), bulk	6.00
Seattle, Wash.—(Gypsum), bulk, ton	10.00
Warren, N. H.	8.50– 9.50
Waukesha, Wis.—(Limestone), per ton	7.00
West Stockbridge, Mass.	¶7.50–‖9.00
Wisconsin Points—(Limestone), per ton	15.00

(a) F.o.b. Middlebury, Vt. ¶C.L. ‖L.C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton Wis.	10.50
Dayton, Ohio	12.50–13.50
Detroit, Mich. (d)	13.00..16.00*
Farmington, Conn.	16.00
Grand Rapids, Mich.*	14.50
Iona, N. J.	12.00
Jackson, Mich.	13.00
Madison, Wis.	12.50a
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	9.00*
Mishawaka, Ind.	11.00
New Brighton, Minn.	8.00
Pontiac, Mich. (e)	15.50
Portage, Wis.	15.00
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	12.50
Sebewaing, Mich.	12.50
South River, N. J.	11.00
South St. Paul, Minn.	9.00
Syracuse, N. Y.	18.00–20.00
Toronto, Canada	b13.00–15.00*
Winnipeg, Canada	15.00

Delivered on job. (a) Less 50c disc. per M 10th of month. (b) 5% disc., 10 days. (c) Delivered in city. (d) Also 15.50. (e) Truck delivery.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

City or shipping point	Size 8x8x16
Appleton, Minn.	18.00–20.00
Franklin Park, Ill.: 8x8x16. Per 1000	180.00
Chicago, Ill.:	
8x 8x16. Each	.21†
8x 8x16. Each	.18b
8x10x16. Each	.25†
8x10x16. Each	.22b
8x12x16. Each	.28†
8x12x16. Each	.25b
Columbus, Ohio	14.00b–16.00†
Forest Park, Ill.	21.00*
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12a
Lexington, Ky.:	
8x8x16	a18.00*
8x8x16	b15.00*
Los Angeles, Calif.:	
4x8x12	4.50*
4x6x12	3.90*
4x4x12	2.90*

*Price per 100 at plant.
†Rock or panel face.
(a) Face. (b) Plain. (c) Common.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Clyde, Ill.—French tile, 9x15-in., per sq., 9.50–¶11.50; Spanish, 9x15-in., per sq., 10.00–12.00; Shingle, 9x12-in., per sq. 11.00–13.00

Detroit, Mich.—5x8x12, per M	67.50
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Lexington, Ky.—8x15, per sq.:	
Red	15.00
Green	18.00
Longview, Wash.:	
4x6x12-in., per 1000	55.00
4x8x12-in., per 1000	65.00

Cement Building Tile

Chicago District (Haydite):	
8x 4x16, per 1000	140.00
8x 8x16, per 1000	200.00
8x12x16, per 1000	300.00
Columbus, Ohio:	
5x8x12, per 100	6.00
Lexington, Ky.:	
5x8x12, per 1000	55.00
4x5x12, per 1000	35.00
Longview, Wash. (Stone Tile):	
4x6x12, per 1000	57.50
4x8x12, per 1000	65.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Camden & Trenton, N. J.	17.00	——
Chicago District "Haydite"	14.00	——
Columbus, Ohio	16.00	17.00
Ensley, Ala. ("Slagtex")	10.00–13.00a	....
Forest Park, Ill.	....	37.00
Longview, Wash.	16.50	23.00– 40.00
Milwaukee, Wis.	14.00	....
Omaha, Neb.	18.00	30.00– 40.00
Philadelphia, Penn.	15.50	....
Portland, Ore.	12.00	22.50– 55.00
Prairie du Chien, Wis.	14.00	22.00– 25.00
Rapid City, S. D.	18.00	25.00– 40.00

(a) Delivered on job; 10.00 f.o.b. plant.

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00

Stone-Tile Hollow Brick

Prices are net per thousand f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.	....	53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.	....	55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans, La.	35.00	45.00	60.00
Norfolk, Va.	35.00	50.00	65.00
Passaic, N. J.	35.00	50.00	65.00
Patchogue, N. Y.	....	60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% disc.

Current Prices Cement Pipe

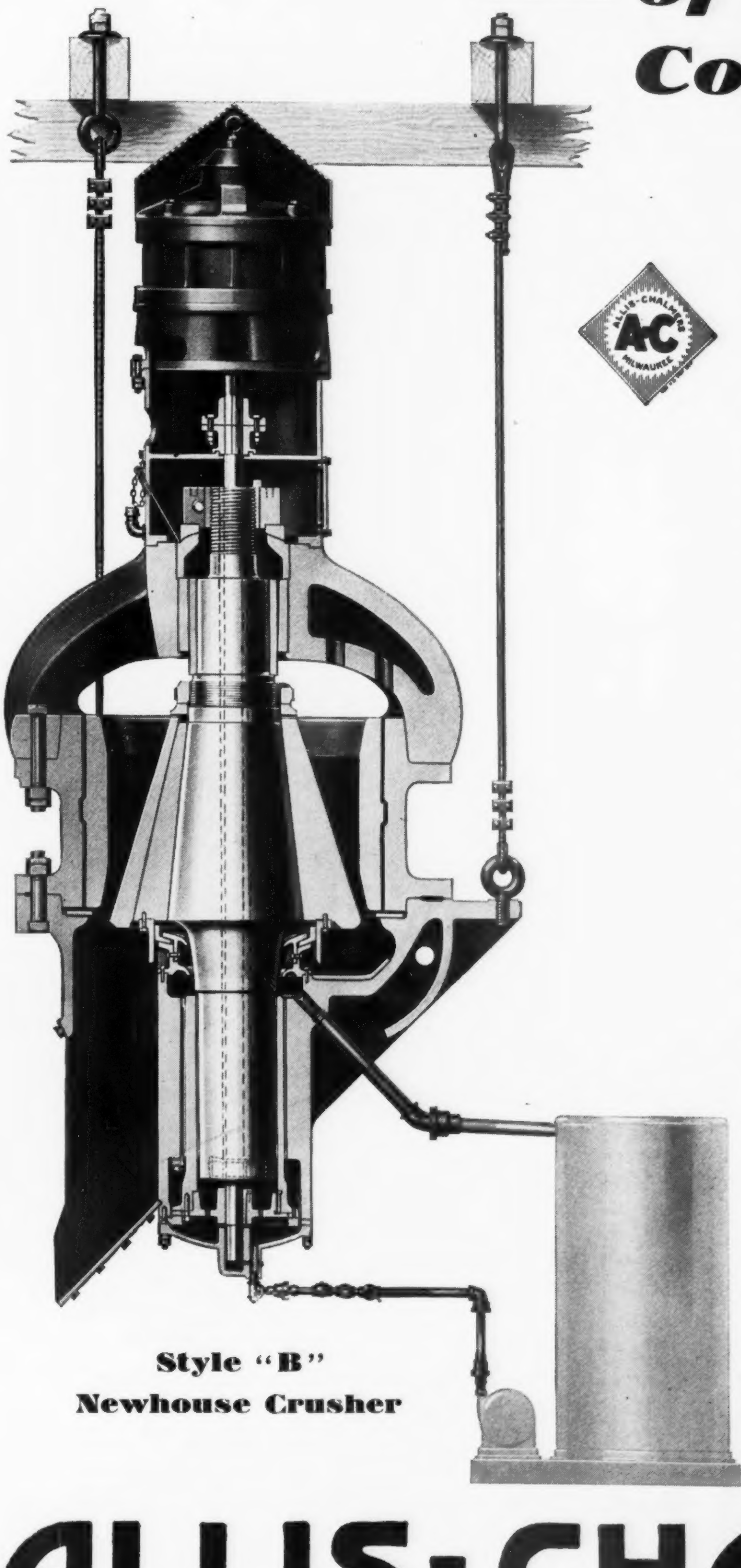
Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10-in.	12-in.	15 in.	18-in.	20-in.	22-in.	24-in.	27-in.	30-in.	36-in.	42-in.	48-in.	54-in.	60-in.
Grand Rapids, Mich. (b)																	
Sewer	......	.12	.18	.27⅓	.35	.47	.92½	1.11	......	1.66½	2.47	2.73⅔	......	......	......	......	......
Culvert	......	......	......	.57	.67	.93	1.20	......	......	1.80	2.10	2.25	3.35	4.00	5.60	6.90	7.85
Indianapolis, Ind. (a)	......	......	......	.75	.85	.90	1.15	......	......	1.60	......	2.50	......	......	......	......	......
Newark, N. J. (d)	......	......	......	......	.85	.95	1.25	1.40	1.56	2.09	2.30	3.15	4.05	5.15	6.35	7.65	......
Norfolk, Neb. (b)	......	......	......	.90	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Tiskilwa, Ill. (rein.)	......	......	......	.75	.85	.95	1.20	1.60	......	2.00	......	2.75	3.40	......	6.50	......	10.00
Tacoma, Wash.	.15	.17	.22½	.30	.40	.55	.70	......	......	......	......	......	......	......	......	......	......
Wahoo, Neb. (c)	......	......	......	......	.85½	......	1.14	......	......	1.81	......	2.47	3.42	4.13	5.63	6.49	7.31

(a) 24-in. lengths. (b) Sewer, 21-in., 1.48; culvert, 21-in., 1.45. †21-in. diam. (c) Reinforced, 15.40 per ton, f.o.b. plant. (d) Reinforced.

A Better Crusher

—of Simplified Construction



Style "B"
Newhouse Crusher

THE thought uppermost in the minds of crushing plant operators is in producing the maximum amount of finished product at the lowest cost.

The Style "B" Newhouse Crusher will do this. It is a high production machine. Due to its large unobstructed feed opening and its peculiar crushing action, it is easy to feed and will take large size material without bridging. Its short, rapid, crushing stroke gives it large unit capacity with a high percentage of the finished product of cubical shape and of uniform size.

The simplicity of the Newhouse Crusher makes it an economical machine to operate and to maintain. The absence of gears will be noted from the sectional view. There are few working parts and these are readily accessible.

The Newhouse Crusher is well suited to fit into present installations. It requires little head room. It may be suspended from the framework of a building by means of cables. The use of this crusher in new plants will simplify plant layout and reduce building costs.

The details of this *crusher that requires no foundations* are described in Bulletin 1469-A. Write for a copy. Or better still, let an Allis-Chalmers Engineer show you what this crusher can do.

ALLIS-CHALMERS MFG. CO.
MILWAUKEE, WIS.

ALLIS-CHALMERS

News of All the Industry

Incorporations

Storey Lime Co., Prescott, Ariz., $100,000.

Artstone Quarries, Inc., Etowah, Tenn., $50,000. August J. McClary, Clyde Rule and E. Rhode.

Bird Lime and Cement Co., San Antonio, Tex., increased capital stock from $10,000 to $20,000.

Renton Sand and Gravel Co., Renton, Wash., $15,000. G. A. Harner and Ethan Allen Peyser.

Oceanside Rock and Sand Co., Carlsbad, Calif., $25,000. Robert W. Baird and C. M. Davy of Carlsbad, Calif., and J. R. Wotring of Long Beach.

Watauga Stone Co., Watauga, Tenn., $250,000. Charles M. Seymour, A. I. Brown, F. P. Denham, E. L. Blanton and C. A. Shiebel.

Reliable Sand and Gravel Co., Canton, Ohio, 50 shares at $100 each. John P. Butcher, James L. Ammerman and James H. Emsley.

Babylon Sand and Gravel Co., Babylon, N. Y., $100,000 preferred and 10,000 shares common. A. S. Smith, 70 Wall St., New York City.

Blanco River Gravel Co., Austin, Tex., $25,000. To produce and sell sand and gravel. W. J. McDaniel, H. G. McDaniel and G. M. Magill.

McKay Sand and Gravel Co., Eugene, Ore., $10,000. J. R. McKay, H. B. Ruth and Howard Platt.

Wiley Gravel Co., West Alexandria, Ohio, 100 shares, no par value. Clarence Wiley, Alberta Wiley, Walter R. Wiley and Thomas J. Hart, 209 Ludlow Bldg., Dayton, Ohio.

Colgan Ready-Mix Concrete and Sand Corp., Brooklyn, N. Y., 50,000 shares, no par value. George A. Colgan, 201 Ocean Ave., Brooklyn, George A. Colgan, Jr., and Frank G. Colgan.

Contractors Sand, Gravel and Supply Co., 212 Hazen Bldg., Cincinnati, Ohio, $100,000. Pinckney Brewer, Joseph A. Byrnes, Clarence Murdock, Philip Freshwater, Michael Hannon and Alfred F. Deckebach.

Fulton County Stone Corp., 10 N. Main St., Gloversville, N. Y., $40,000. To produce and sell crushed stone. Morrell Vrooman, president; Joseph Sandfordt, vice-president and secretary, and George M. Naigney, treasurer.

Glenridge Stone Co., Millersburg, Ohio, $50,000 and 1500 shares of no par value. Charles F. Schnee, Vernon H. Schnee, Treve Marshall, and Grimm and Belden, Second National Bldg., Akron, Ohio.

Quarries

Alburtis Stone and Sand Co., Inc., Alburtis, Penn. Filed involuntary petition in bankruptcy.

Avoca Quarries Corp., Bedford, Ind., has filed papers evidencing preliminary dissolution.

National Lime and Stone Co. has resumed work at its Mineral Ridge, Ohio, plant after a temporary shutdown for a period of two months.

The Carbon Limestone Co., Youngstown, Ohio, has moved its offices to 1504-7 Central Savings Tower, Youngstown.

Southern Quarries, Inc., Elberton, Ga., is to erect a one-story unit at its plant, 45x200 ft., to be equipped with electric traveling crane of 20-ton capacity and other material handling equipment.

Cottage Grove, Ore. The Quicksilver Syndicate, which owns properties near here, has uncovered a deposit of high-grade limestone in the mines of Black Butte. A tunnel has been driven into the deposit for a distance of 100 ft. and the company plans to start mining the product soon.

Hot Springs, S. D. The stone quarries owned by Henry Bering southeast of Hot Springs have been reopened. The Chicago and Northwestern railway recently finished a new spur track to the quarries and new machinery is being installed to increase production.

Fulton County Stone Corp., Gloversville, N. Y., recently incorporated, has a quarry and plant on the Robinson farm east of Mayfield, N. Y. The quarry was formerly owned by the Anibal estate and the Mayfield Stone Co., and was purchased by the former a short time ago. It is said to be the largest crushing plant in this section.

Sharon Springs Stone Co., Sharon Springs, N. Y., has acquired the J. Spencer Hyney quarry, which was opened a few years ago by David Ripton, and started to operate the quarry on June 2. Officers of the new company are Duane Spraker, president; J. Lester Hone, vice-president, and L. J. Lipe, secretary and treasurer.

American Lime and Stone Co., Bellefonte, Penn. A blast of 60,000 lb. of dynamite at the Tyrone, Penn., quarry of the company loosened approximately 250,000 tons of rock, which will be used in the current construction program of the state highway department. Sixteen vertical holes, 5 in. in diameter and 190 ft. deep, were drilled in the quarry in preparation for the blasting. The dynamite, which was 60% nitroglycerine, was contained in cartridges 5 in. in diameter and 16 in. long.

Watauga Stone Co., Watauga, Tenn., a new company formed recently by the Thomas McCroskey interests, will operate two plants in Carter county, Tenn., a crushed stone quarry at Watauga and a deposit of river sand at Siam, five miles east of Elizabethton, Tenn. Work has been started on both plants. The limestone quarry will be in operation on July 1 and the sand plant before August 1. Howard Young is president of the new company and Robert S. Campbell is vice-president. Henry McCroskey is treasurer and Charles M. Seymour secretary. Mr. Campbell, who is manager of the McCroskey enterprises in Tennessee, Georgia and the Carolinas, will direct the development of the stone quarry and sand plant. Equipment in the two plants, it is said, will cost approximately $150,000.

Sand and Gravel

Western Hills Sand and Gravel Co., Cincinnati, Ohio, has appointed Charles C. Sanders general manager to succeed Frank J. Ulrich.

Greene Gravel Pit, Clinton, Wis., operated by I. Wheeler, recently installed a new crusher for crushing gravel. Ernest Brown is engineer at the pit.

Cement

Arkansas Portland Cement Co., Okay, Ark., is installing new machinery which will give the plant a capacity of from 2700 to 3000 bbl. of cement daily.

Lime

Lime Products Co., Little Rock, Ark., has leased its plant to the Arkansas Lime Products Co. of Texarkana, Ark.

Glencoe Lime and Cement Co., St. Louis, Mo., has leased the second floor at 1608 Pine St., St. Louis, and the general offices of the company will occupy this space after July 1.

The Haden Lime Co., Houston, Tex., has issued an interesting booklet outlining the advantages of lime as an effective reagent for the removal of hydrogen sulphide from gases, and the adaptability of its oyster-shell chemical hydrated lime for this purpose.

Cement Products

Boston Concrete Corp., a subsidiary of the Boston Sand and Gravel Co., Boston, Mass., is expanding its operation at Cambridge, Mass., for the production and distribution of ready-mixed concrete. The expansion program involves a cost of $70,000.

Welsh and Struhsaker, Waterville, Ohio, has installed additional machinery and made various improvements in its cement block plant, located on the Whitehouse road near the Lima-Toledo railroad. In addition to manufacturing cement block, brick, etc., the company is now making a cement marker, weighing 40 lb., suitable for marking graves and for other purposes.

Miscellaneous Rock Products

Fullers Earth Co., 10616 Euclid Ave., Cleveland, Ohio, is installing machinery and equipment at its plant at Midway, Fla., at a cost of $30,000, to double present capacity of 100 tons daily.

United States Potash Co., operated by Snowden McSweeney Co., 598 Madison Ave., New York City, is to erect a mining and refining plant on potash properties in the vicinity of Hobbs, N. M.

Texas Potash Corp., Dallas, Tex., will erect a plant for refining potash, to handle 1000 tons raw material daily. Max Agress, Republic National Bank Bldg., Dallas, is director.

Personals

W. L. Lewis, formerly assistant comptroller of the Bethlehem Steel Corp., was elected vice-president, secretary and treasurer of the Chicago Pneumatic Tool Co., New York City, at the recent board of directors' meeting. Mr. Lewis succeeds J. G. Grimshaw, secretary and treasurer, who resigned.

W. N. Fitzgerald, Jr., has been appointed to the sales department of the Industrial Division of Continental Motors Corp., Detroit, Mich. Mr. Fitzgerald has had a wide experience in the industry, having been associated with the A. O. Smith Corp., Milwaukee, the International Harvester Corp., and the Wisconsin Engine Co.

L. C. Newlands of the Oregon Portland Cement Co., Portland, Ore., was made vice-president of the newly organized Oregon Safety Congress formed in Portland on June 7 by industrial leaders from all parts of the state "to carry the message of safety to mill, factory, forest and workshop." Mr. Newlands is also president of the Portland Chamber of Commerce.

David B. Reger of Morgantown, W. Va., has resigned his position as associate geologist of the West Virginia Geological Survey, effective August 31, 1930. His future plans have not been announced. Mr. Reger began his scientific work as field assistant with the United States Geological Survey in 1903, and in 1909 entered the service of the West Virginia Survey as a field assistant. In 1913 he became assistant geologist, and from December, 1927, until October, 1929, was in administrative charge of the survey, following the death of Dr. I. C. White. Since 1929 he has been associate geologist.

Scott Turner, director of the United States Bureau of Mines, has been designated by the Secretary of State as a delegate for the United States to the second plenary meeting of the World Power Conference to be held at Berlin, Germany, the latter part of June. He has also been appointed as one of the two American delegates to the International Congress of Mining, Metallurgy and Applied Geology, to be held at Liége the end of June. Mr. Turner is also an official delegate of the American committee of the World Power Conference, and carries the credentials of the American Institute of Mining and Metallurgical Engineers to the same conference.

Guiseppe Faccioli, widely known in the electrical industry, has retired from active participation in the affairs of the General Electric Co. because of ill health. Mr. Faccioli has relinquished his duties as Pittsfield works engineer and associate manager of the Pittsfield works of the company and has assumed the position of consulting engineer. He became identified with the General Electric Co. in 1908 and has spent considerable time at Schenectady, where he was associated with the late Dr. Charles P. Steinmetz, whose researches in the field of lighting became famous. These studies were continued at Pittsfield by Mr. Faccioli and, according to the company, they contributed in no small measure to the success of the now famous high-voltage laboratory.

Manufacturers

Continental Motors Corp., Detroit, Mich., will have a general vacation for all employes for two weeks beginning June 29 and ending July 14.

American Arch Co., Inc., New York City, has moved its main office from 17 East 42nd St. to the Lincoln Bldg., 60 East 42nd St., New York City.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has received an order for 20 synchronous motors and control equipment to drive pumps in booster stations on oil pipe lines between Sand Spring, Okla., and Chicago.

Trackson Co., Milwaukee, Wis., has appointed the Millsap Road Machinery Co., 23rd St. and 23rd Ave., Birmingham, Ala., as a new distributor of Trackson tractor equipment in the Birmingham territory.

Wagner Electric Corp., St. Louis, Mo., announces the addition of Mr. Herbert Hoover, formerly general distribution engineer of the Potomac Electric Power Co., to its Philadelphia branch sales office. Mr. Hoover's territory will comprise the states of North Carolina and Virginia.

Hercules Motors Corp., Canton, Ohio, has appointed Walter F. Radtke as Pacific Coast sales representative. Mr. Radtke, who formerly represented Hercules in the Mid-Continent states, took over his new duties on June 1. He will make his headquarters in the newly opened Hercules office, Room 601 Russ Bldg., San Francisco, Calif.

The Brown Instrument Co., Philadelphia, Penn., has just let a contract for 40,000 sq. ft. of additional floor space to the Robert E. Lamb Co. of Philadelphia, Penn. This extra space will be in the form of two additional floors on all of the new two-story concrete sections of the plant. Construction will be started very shortly and the new space will be occupied early this fall.

The Prest-O-Lite Co., Inc., New York City, announces the opening of a new plant for the manufacture of dissolved acetylene at 1240 Stewart Ave., S.W., Atlanta, Ga. With the opening of the new plant the old plant at 345 Kuhrt St., Atlanta, will discontinue operations. The company will also erect a plant on seven acres of land in the Eastwood section of Syracuse, N. Y., adjacent to the New York Central freight tracks.

Blaw-Knox Co., Pittsburgh, Penn., announces that Blaw-Knox International Corp. is the new name for the export organization of the Blaw-Knox Co., which was formerly known as Milliken Bros.-Blaw-Knox Corp. The change in name is due to the larger scope of the company's activities, and embraces no change in personnel. Offices will remain, as formerly, in the Canadian Pacific Bldg., New York City.

Gardner-Denver Co., Denver, Colo., has developed at its Quincy, Ill., plant a twin roller bearing rotary drilling engine of light and compact construction, designed to operate with 350 lb. steam pressure. The engine is 9 ft. ½ in. long and has a width of 6 ft. 5 in. The height of the engine proper is 3 ft. 11⅝ in., with an overall height of 4 ft. 7¾ in., and the total weight installed is 14,000 lb. The new product is to be known as model DEB.

Independent Pneumatic Tool Co., Chicago, Ill., has purchased the Cochise Rock Drill Manufacturing Co. of Los Angeles, Calif., manufacturing a line of rock drills and mining tools. It is planned to expand the plant of the Cochise company, employ additional workmen, and incorporate the products manufactured by that company in the present line of the Independent Pneumatic Tool Co. The Cochise company will operate as a unit of Independent Pneumatic Tool Co. and there will be no change in personnel or methods.

Republic Steel Corp. has completed the installation of a new 25-ton electric furnace at the Canton, Ohio, plant. The new furnace, which costs approximately $200,000, enlarges the company's battery of electric furnaces to six. H. S. Schroeder has been appointed western manager of sales for the company, with headquarters in Chicago. Mr. Schroeder formerly was vice-president and general sales manager of the Interstate Iron and Steel Co., Chicago. H. W. Craig will be sales manager of the Chicago district, with L. S. Simmonds and J. F. Mehlhope as assistant district sales managers. Mr. Craig and Mr. Simmonds formerly held similar positions with the Republic Iron and Steel Co., while Mr. Mehlhope formerly was Chicago district manager for the Central Alloy Steel Corp.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Chart for Shovel Buyers. Unusual chart for the use of shovel buyers, explaining eight fundamental merits upon which a shovel should be judged. THE WOOD SHOVEL AND TOOL CO., Piqua, Ohio.

Locomotives. A 32-page booklet illustrating and describing Heisler locomotives, with complete construction details, tables giving hauling capacities on various grades, etc. HEISLER LOCOMOTIVE WORKS, Erie, Penn.

Dryers and Grinding Mills. A new folder on the nine different types of Ruggles-Coles dryers designed for a wide variety of drying needs, and mills for grinding cement clinker, limestone and other products. HARDINGE CO., York, Penn.

Portable Equipment. Broadside describing portable power propelled unit, portable track feeder, and portable drag conveyor, with photographs of actual installations of Fairfield portable equipment in various industries. THE FAIRFIELD ENGINEERING CO., Marion, Ohio.

Chemical Elements. A very interesting and informative folder, entitled "The 92 Elements," giving the numbers, names, symbols, atomic weights, melting points and years of discovery, as far as known, of the chemical elements. P. C. KULLMAN AND CO., New York City.

Compartment Mills. Circular describing Traylor three-compartment mills for producing from 125 to 150 bbl. per hour of high early strength portland cement to as high as 94% through 200 mesh. TRAYLOR ENGINEERING AND MANUFACTURING CO., Allentown, Penn.

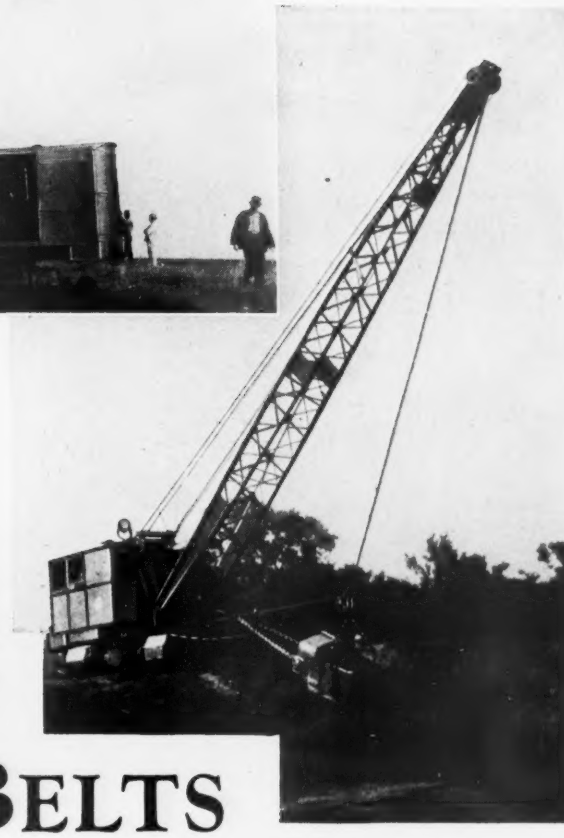
Concrete Machinery. No. 6 of "Consolidated Contact," a little journal of news items of interest to concrete products producers, and illustrating and describing the equipment manufactured by the CONSOLIDATED CONCRETE MACHINERY CORP., Adrian, Mich.

Screw Conveyor Drives. Book **No. 1191**, a 32-page book describing the complete line of Caldwell screw conveyor drives. Illustrations of these drives and typical installations of the equipment, as well as engineering data to aid in the selection of the most efficient and economical drive for the individual purpose are given. H. W. CALDWELL AND SON CO., 2410 West 18th St., Chicago, Ill.

Motors. A new 16-page bulletin on Fynn-Weichsel motors, containing a discussion of the problem of poor power factor, the cost of poor power factor, early attempts at power factor correction, and the application of the Fynn-Weichsel motor to its solution, complete with illustrations. WAGNER ELECTRIC CORP., St. Louis, Mo.

Electrical Handbook. An electrical handbook, data for which were compiled by the most representative technical men in each industry covered in its twelve sections having the following classifications: Illumination, industrial control, industrial heating, material handling, motors, refrigeration, signals, signs, switchboards and panelboards, tools, ventilation and wiring. The book gives facts on each of the foregoing subjects that are of interest to both the buyer and the seller of such equipment in each respective field. ELECTRICAL ASSOCIATION OF NEW YORK, New York City.

Chain Drives. Booklet entitled **"Green List No. 1357"** on roller chain drives from ½ to 100 hp.; booklet gives instructions for figuring a suitable drive, horsepower tables of the various drives, and complete specifications. **Pink List No. 725** covers silent chain drives from ½ to 60 hp., and completely describes and illustrates the use of these drives in various industries, giving tables for determining the length of chain, tables of measurement and instructions for their installation and operation. Book **No. 870**, entitled "Some of the Products Link-Belt Makes," contains a pictorial review of the company's conveyors, sand separators, car dumpers, loaders, skip hoists, screens, worm gears, locomotive cranes, shovels, and other equipment. LINK-BELT CO., Chicago, Ill.



3 LINK-BELTS

speeded this Texas job

ABOUT 100,000 cubic yards of soft fill material had to be removed in this fill renewal job on the Southern Pacific Railway, north of Houston, Tex.

W. H. Nichols & Co., of Dallas, were contractors, and their two 1-yard Link-Belt Crawlers, used in this service are shown above (at the sides).

The contractor equipped these machines with oversize ($1\frac{1}{2}$-yd.) dragline buckets. Conservative factory rating of the machines made this safely possible.

New material for the fill was dug and loaded by the $1\frac{1}{4}$-yard Link-Belt Shovel shown (at top). Although the new material was of hard formation, 16-yard cars were loaded at the rate of one in 10 to 12 minutes.

The through-and-through good quality in Link-Belt crane-shovel-dragline is the basis of all these stories of good service. Get the details regarding these machines from Book No. 1095, which will be mailed upon request.

LINK-BELT COMPANY

Builders of Locomotive Cranes for 30 years. Portable Loaders—Crawler Cranes—Shovels—Draglines

CHICAGO, 300 W. Pershing Road — Offices in Principal Cities

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LINK-BELT

SHOVELS + CRANES + DRAGLINES


"Uniform
vibration
keeps meshes
open"

What More can one Ask ?

LOOK at these actual working illustrations of the Moore Speedshovel owned by A. Guthrie & Company, St. Paul, Minnesota, working in stone at Dover, New Jersey. Seven tons is the weight of the stone shown in the picture to the right.

Surely a shovel that has the ability to work here is well designed and sturdily constructed. The Moore Speedshovel "Made in Manitowoc", can safely handle heavy materials due to its low center of gravity. It's easy for the operator too because he "gets the feel" with the foot accelerator, long used on this equipment.

You will find the new catalog interesting—write for a copy today.

MANITOWOC ENGINEERING WORKS, *Manitowoc, Wis.*

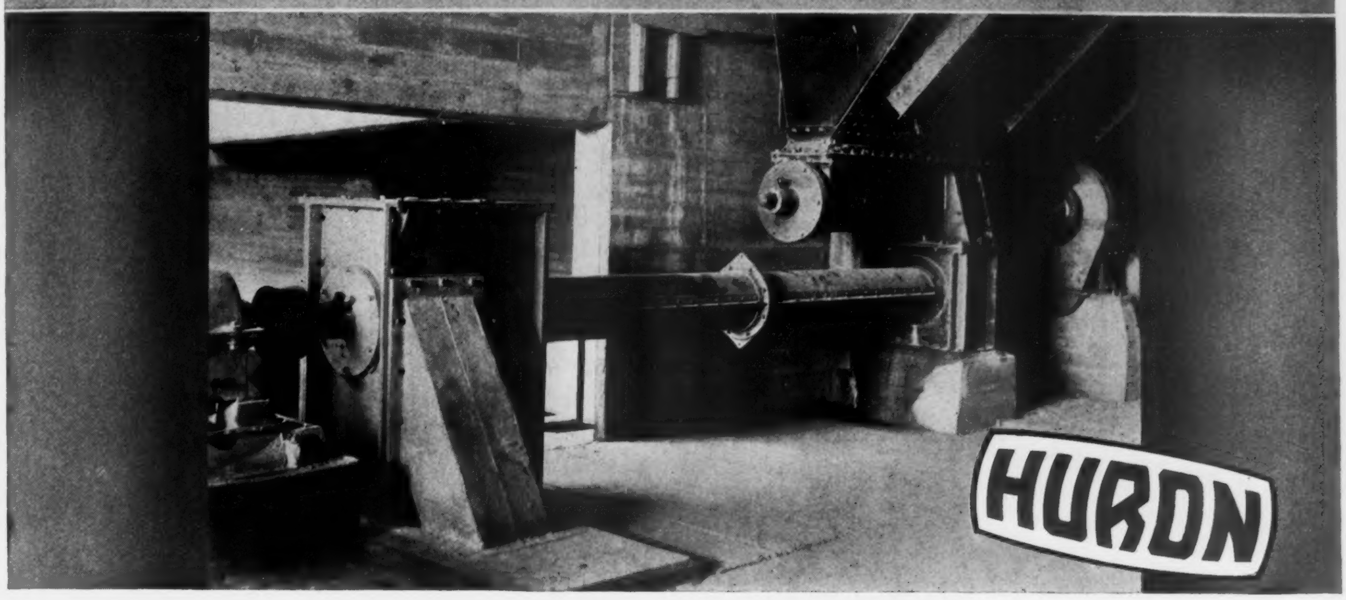
(Sole Licensee to manufacture and sell Moore Speedcranes, Shovels, Draglines and Trenchoes)

SPEEDCRANE

MOORE • MANITOWOC

SHOVEL ~ CRANE ~ TRENCHOE ~ DRAGLINE

A FEEDER of Entirely NEW Design



Feeds Pulverized Coal, Raw Mix and Other Fine Materials at a Uniform Rate

Delivery of a definite quantity of material at a definite rate is insured by HURON Feeders. Rate of feed can be accurately determined and regulated. Flooding is eliminated. Bridging-over is prevented.

Design and construction are the outcome of development under actual operating conditions. Simplicity makes investment and maintenance a minimum. Each feeder consists essentially of a receiving box, a feeding box, three gear-driven conveyor screws, and a discharge box. There are no fine adjustments, no parts that are subjected to excessive wear, and no complicated parts that might get out of order and be difficult to replace. In fact, all of the parts are of the kind with which operators of this class of equipment are familiar.

Made in three sizes—with 6-inch, 9-inch or 12-inch conveyor screws. Use the coupon and complete details will be sent to you.

HURON Feeders Aerate the Material and Deliver It to the Burner or Kiln at a Uniform Density and Rate

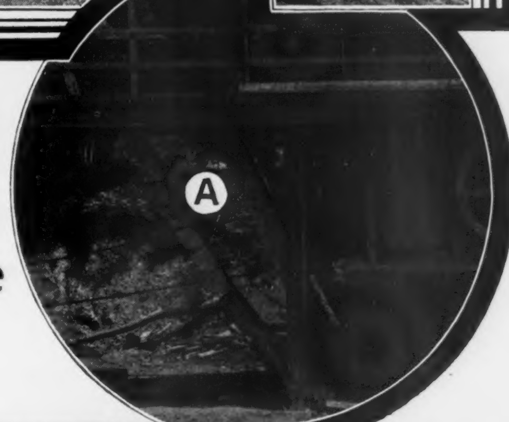
HURON INDUSTRIES, INC.
ALPENA, MICH.

HURON INDUSTRIES, Alpena, Mich.
Send me complete information on HURON Feeders.
Name..........
Company..........
City..........
State..........


8 UNIVERSAL SCREENS
AT LOCKPORT, ILL.

Properly Planned

. . . this Telsmith Quarry Plant has every feature for Efficient Service

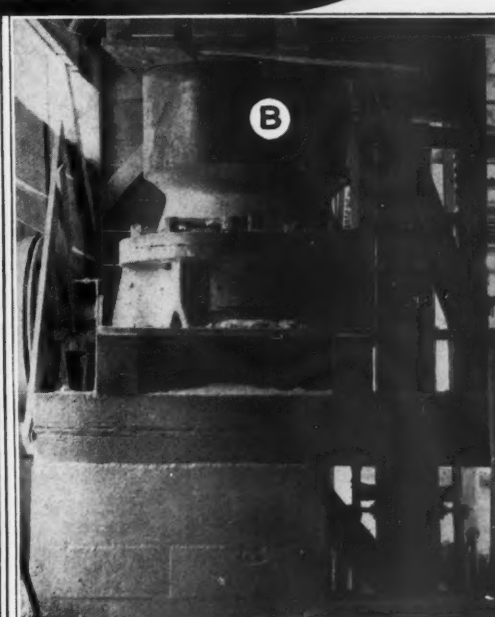


RATHER than remodel their old quarry plant, Hoffman Bros. & Wilson, Harrisburg, Pa. . . . after surveying several eastern plants . . . commissioned Telsmith to design a complete new plant and furnish the machinery. Construction began January 8th and plant was completed April 10, 1929, in spite of winter conditions.

Since the location is a long, narrow strip of land between a truck road and the railway siding, Telsmith designed a double bin, straight line type plant to best use these facilities and provide separate storage for ten stone grades. Capacity is 600 tons per day, with provision for increase to 800 and 1000 tons later.

Steam shovels load the quarry rock into dump cars, which are drawn up a double incline track by electric hoists, and discharge into a hopper above a jaw crusher. A No. 9 Telsmith Belt Elevator (A) 55 ft. long, with 30 x 16 in. buckets, discharges crushed material to a 60 in. x 24 ft. Telsmith-Hercules Screen, equipped with Timken Roller Bearings, which is over the 5-section primary bin. Minus 2¾ in. and tailings go into fifth bin section and a 20 x 18 in. Telsmith Siquad Bin Gate, with chute, feeds it to a No. 40 Telsmith Reduction Crusher (B). From this crusher, a 59 ft. No. 6 Telsmith Belt Elevator delivers to a 60 in. x 24 ft. Telsmith-Hercules Screen over the secondary five-section bin. On one side of plant delivery to trucks is made by ten 16 x 18 in. Telsmith Siquad Bin Gates and on the other side to railroad cars by ten 20 x 18 Telsmith Siquad Bin Gates. Trucks load from both sides when cars are not loading.

The plant has worked steadily and satisfactorily . . . without a single hitch . . . since the juice was first turned on. This instant success is largely attributable to quality equipment and sound engineering counsel. Telsmith Balanced Service plans, builds, and guarantees complete quarry and gravel washing plants. Write for Bulletin Q11.



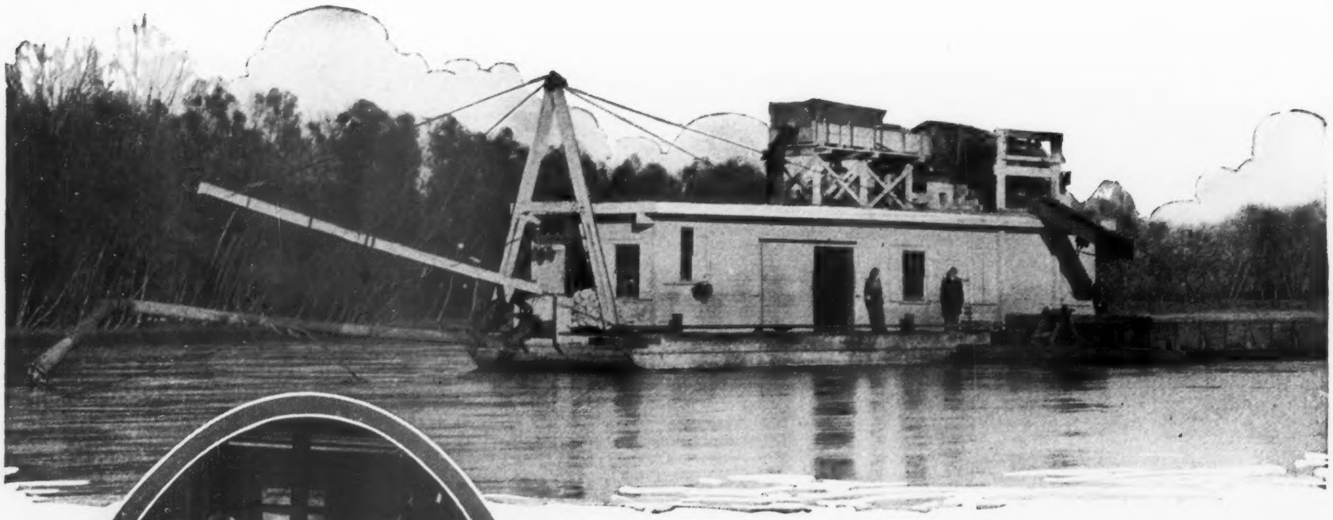
SMITH ENGINEERING WORKS
86 Capitol Drive **Milwaukee, Wis.**

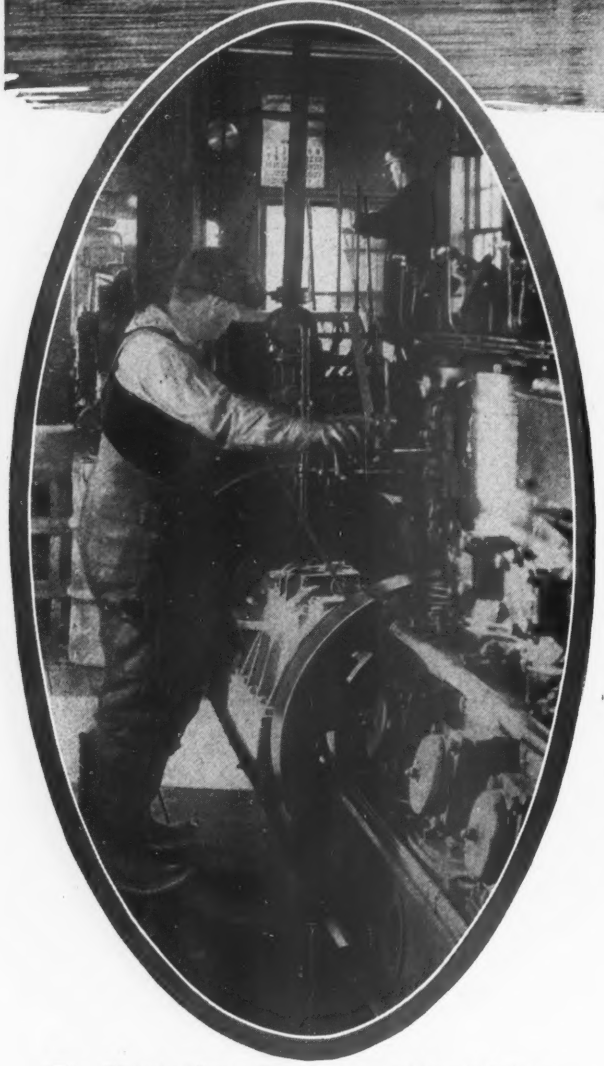
Canadian Representatives:
Canadian Ingersoll-Rand Co., Ltd., Montreal, P. Q.

11 West 42nd St. New York City	1442 Builders Bldg. Chicago, Illinois	Harrison Bldg. Philadelphia, Pa.
V. L. Phillips Co. Kansas City, Mo.	Choctaw C. & M. Co. Memphis, Tenn.	J. W. Bartholow Co. Dallas, Texas

Q-3

TELSMITH





A Morris Pump booster for over 30 years

THE King's Crown Plaster Company, of Cedar Rapids, Iowa, started operation in 1888 and has used Morris Pumps throughout its steady development. This Company dredges sand and gravel from the bed of the Cedar River, transporting the marketable material in barges to its plant after segregation at the dredge.

Its Morris Dredge is equipped with a 10-inch manganese steel lined high duty Morris Dredging Pump operated by oil engine, and one of the power boats of this Company is also equipped with an 8-inch Morris Pump for emergency service.

Mr. J. W. Pichner, President of the Company, writes that his present Morris Pumping Equipment, as well as other Morris Pumps previously used, have been satisfactory in every respect and have given extremely gratifying results.

Morris Pumps can serve your own dredging and pumping requirements with similar success. The sixty-six-year experience of the Morris Engineers is sure to be helpful to you in the selection of pumping equipment for your particular operating conditions and is offered without charge or obligation.

This 10-inch Morris Dredge is a self-contained installation. The pump is directly connected to the engine through a friction clutch coupling, while the hoist, priming pump and screening machinery are driven by belt from a counter shaft which is driven by a pulley on the engine. This arrangement permits shutting down the dredging pump without shutting down the auxiliaries or the screens.

MORRIS MACHINE WORKS
Baldwinsville, N. Y.

Originators of Centrifugal Pumps, both Single and Multi-Stage, and builders for practically all purposes since 1864.

Branch Offices:—New York, 225 West 34th Street; Philadelphia, Witherspoon Building; Cleveland, 1367 E. Sixth Street; Chicago, 228 N. La Salle Street; Boston, 79 Milk Street; Pittsburgh, 320 Second Avenue; Detroit, Fisher Building; Charlotte, N. C., Realty Building.

REPRESENTATIVES IN OTHER INDUSTRIAL CENTERS

MORRIS
CENTRIFUGAL PUMPS

272 %
increased service with Tru-Lay
-the experience of a Northern Illinois Contractor

Above is an actual photograph of a piece of Tru-Lay Preformed Wire Rope. Note that the end is not seized. Ordinary wire rope, when cut, unravels. The strands and wires straighten out as the confined internal stress is liberated.

On this Bucyrus 50-B Drag Line, the original equipment was Tru-Lay *Preformed* Wire Rope. It gave 195½ hours of service. After that, ordinary non-preformed wire ropes were installed. Three of them averaged only 52½ hours of service. That is why this contractor became such a staunch booster for Tru-Lay—it gave him 272% increased service.

. . . and this is the reason for *longer wear with Tru-Lay*

Tru-Lay *Preformed* Wire Rope is free from internal stress. Wires and strands are *preformed* to the exact helical shape they assume in the finished structure. This means that instead of being forcibly held in position, each strand lies naturally in position—ready to do its share of the work without internal stress and strain.

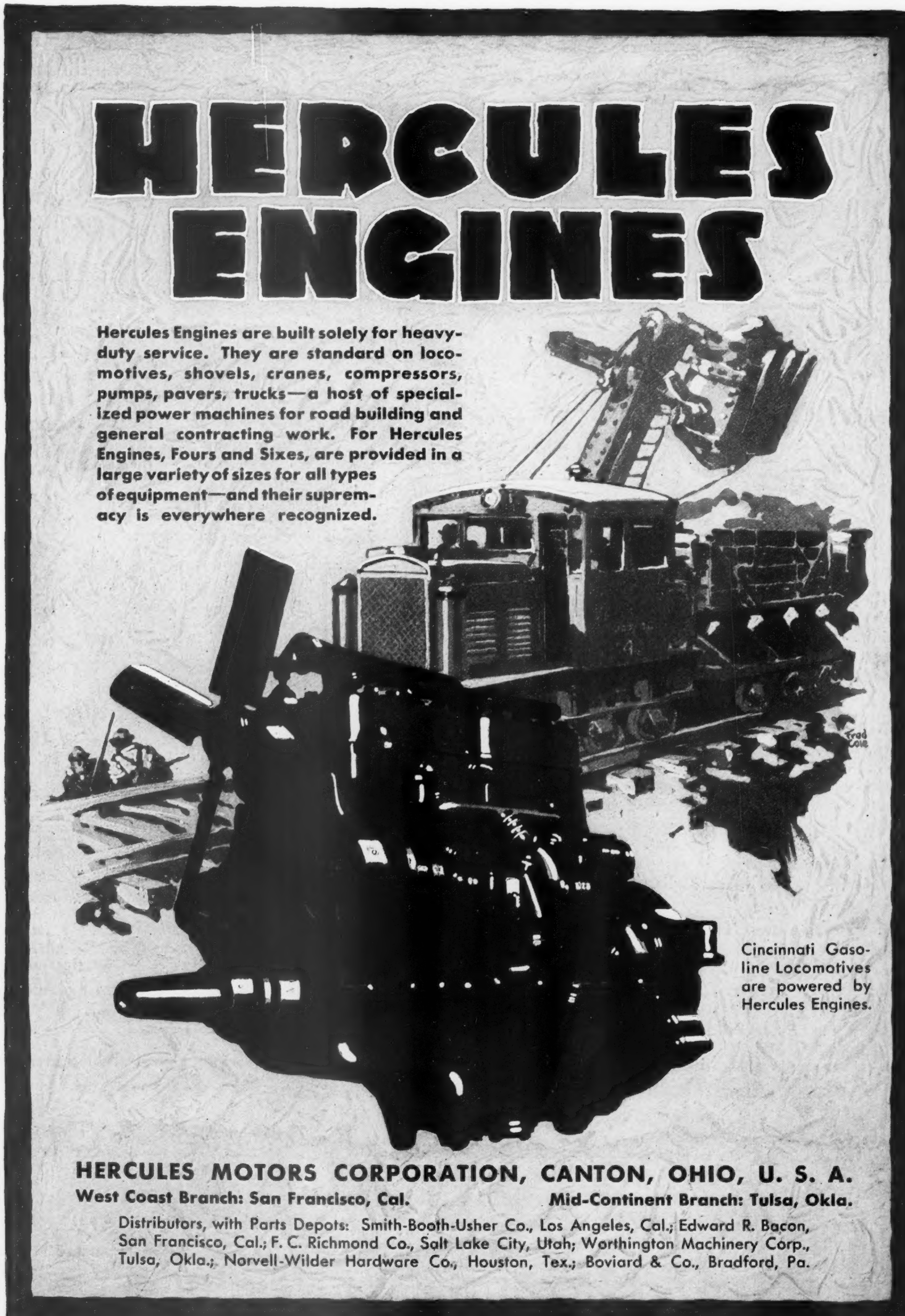
There is no unnatural twisting and rubbing action between strands, or among the individual wires of each strand. *Tru-Lay does not wear itself out internally!* Ordinary wire rope crankiness is eliminated in Tru-Lay—which has the nearest approach to manila rope flexibility ever attained in a steel wire rope.

Cut your wire rope bills. Use Tru-Lay *Preformed* Wire Rope the next time you re-cable.

If you are not acquainted with Tru-Lay, let us mail you a sample length for inspection. Address:

AMERICAN CABLE COMPANY, *Inc.*
New York Central Bldg., 230 Park Ave., New York, N. Y.
An Associate Company of the American Chain Company, *Inc.*
District Offices:
Chicago, Detroit, Philadelphia, Pittsburgh, Tulsa, San Francisco
Canadian Licensed Manufacturers:
Dominion Wire Rope Company, *Limited*, Montreal
Canada Wire & Cable Company, *Limited*, Toronto

PREFORMED WIRE ROPE
TRADE TRU-LAY MARK
(Reg. U. S. Pat. Off.)
Costs less because it lasts longer


HERCULES ENGINES
Hercules Engines are built solely for heavy-duty service. They are standard on locomotives, shovels, cranes, compressors, pumps, pavers, trucks—a host of specialized power machines for road building and general contracting work. For Hercules Engines, Fours and Sixes, are provided in a large variety of sizes for all types of equipment—and their supremacy is everywhere recognized.
Cincinnati Gasoline Locomotives are powered by Hercules Engines.
HERCULES MOTORS CORPORATION, CANTON, OHIO, U. S. A.
West Coast Branch: San Francisco, Cal.
Mid-Continent Branch: Tulsa, Okla.
Distributors, with Parts Depots: Smith-Booth-Usher Co., Los Angeles, Cal.; Edward R. Bacon, San Francisco, Cal.; F. C. Richmond Co., Salt Lake City, Utah; Worthington Machinery Corp., Tulsa, Okla.; Norvell-Wilder Hardware Co., Houston, Tex.; Boviard & Co., Bradford, Pa.

Convertible

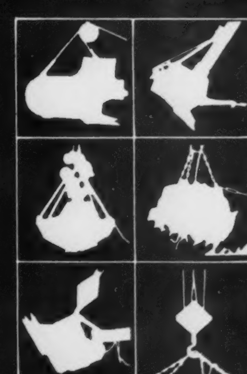
3/4 TO 6 YARDS
COMMANDER
CONQUEROR
VICTOR
RAILROAD
GASOLINE STEAM
ELECTRIC
DIESEL

A 1¼ yard OSGOOD Victor Clamshell owned by Louis Petrillo, Inc., general contractor at Mount Vernon, N. Y., handling sand and gravel from barges to hoppers. Mr. Petrillo says, "I am very much pleased with the work done by this crane. I have had several other cranes, but none has given me the satisfactory service the OSGOOD has. My repair bills have been considerably less and the gasoline consumption reduced."

CHANGED in the FIELD TO ANY SERVICE

NO CHANGES IN OPERATING MACHINERY NECESSARY

OSGOODS are convertible right on the job for many different services—shovel, dragline, clamshell, crane, or backhoe. It isn't necessary to change the operating machinery—just change booms, reeve the cables, start the engine and go to work. Powered with a husky six cylinder engine or single electric motor, the simply designed and sturdily built operating machinery handles all services with a new high efficiency. Even in the toughest going that would quickly 'break' an ordinary machine, an OSGOOD is on the job year in and year out giving trouble free service and piling up profits. Write for OSGOOD facts.

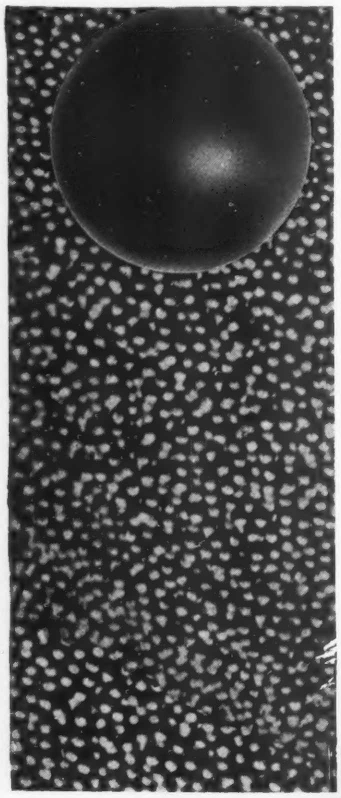


Six services are regularly used on OSGOOD machines—shovel, dragline, clamshell, crane, backhoe and magnet. The OSGOOD shovel boom and handle are the armored type giving maximum strength and resiliency. The crane boom is the bow type ruggedly built in two sections, and equipped with a built-in tagline. A universal fairlead is furnished for dragline service.

THE OSGOOD CO.
MARION OHIO


KNOW
this
low cost
explosive
Cartridges in soaking boxes an hour before the shot
Loading a hole. It is nothing to load and fire 10 holes in 18 minutes
After the blast. Note the uniformity of breakage
EVERY user of explosives should know about Loxite, the Safer, Less Costly Explosive!
—Loxite consists of a carbonaceous cartridge impregnated with liquid oxygen. *There is no explosive in existence* until the cartridge is soaked an hour before the shot and even then it can be handled with perfect safety.
—No special devices are required for detonation.
—It can be handled satisfactorily in water.
—It takes one-tenth of the time ordinarily required for loading and firing.
—It has greater shattering power.
—And it is saving 30% in explosive costs for several large producers.
Here is truly an ideal explosive! Write today for information—tell us your output and let one of our experts go into your blasting problem.
KEITH DUNHAM CO.
522 Westminster Bldg. 110 S. Dearborn St.
CHICAGO, ILLINOIS
Cuts 30% from your explosive bill!
LOXITE
The safer, less costly explosive
RP 6-21 Gray

LORAIN
GRINDING BALLS
FORGED ••• HEAT-TREATED



BY standardizing on LORAIN Forged Steel Heat-Treated Grinding Balls, you insure maximum output. Minimum grinding ball wear is the result of absolutely uniform quality and of definite Brinnell hardness and toughness.

A grinding ball should be purchased on specifications giving carbon and Brinnell ratios, relative to its diameter and the percussive and attritive factors expressed in the individual weight and diameter of the ball.

The day is fast passing when the only specifications applying to a grinding ball is that it shall be approximately round, and approximately to diameter.

The high carbon steel stock used in Lorain Balls is rolled to definite specifications in accordance with standards of the A. S. T. M. for "crop" discard and chemical variants. The heat treatments of the finished Lorain Balls produce definite Brinnell and toughness factors. Let us quote on your grinding ball requirements.

All sizes of balls common to cement and ore grinding, stocked at Johnstown, Pa., in carloads for immediate shipment; and at Denver, Colorado, for less carload shipments:—¾", ⅞", 1", 1¼", 1½", 1¾", 2", 2½", 3", 3½", 4", 4½", 5".

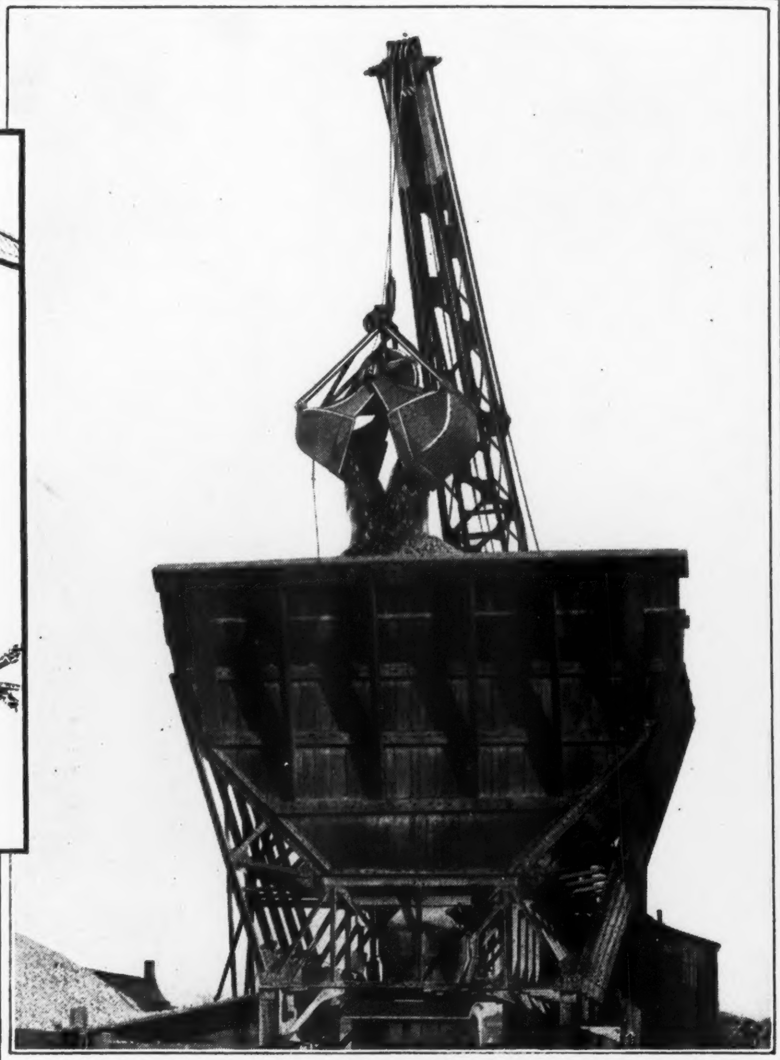
THE LORAIN STEEL COMPANY

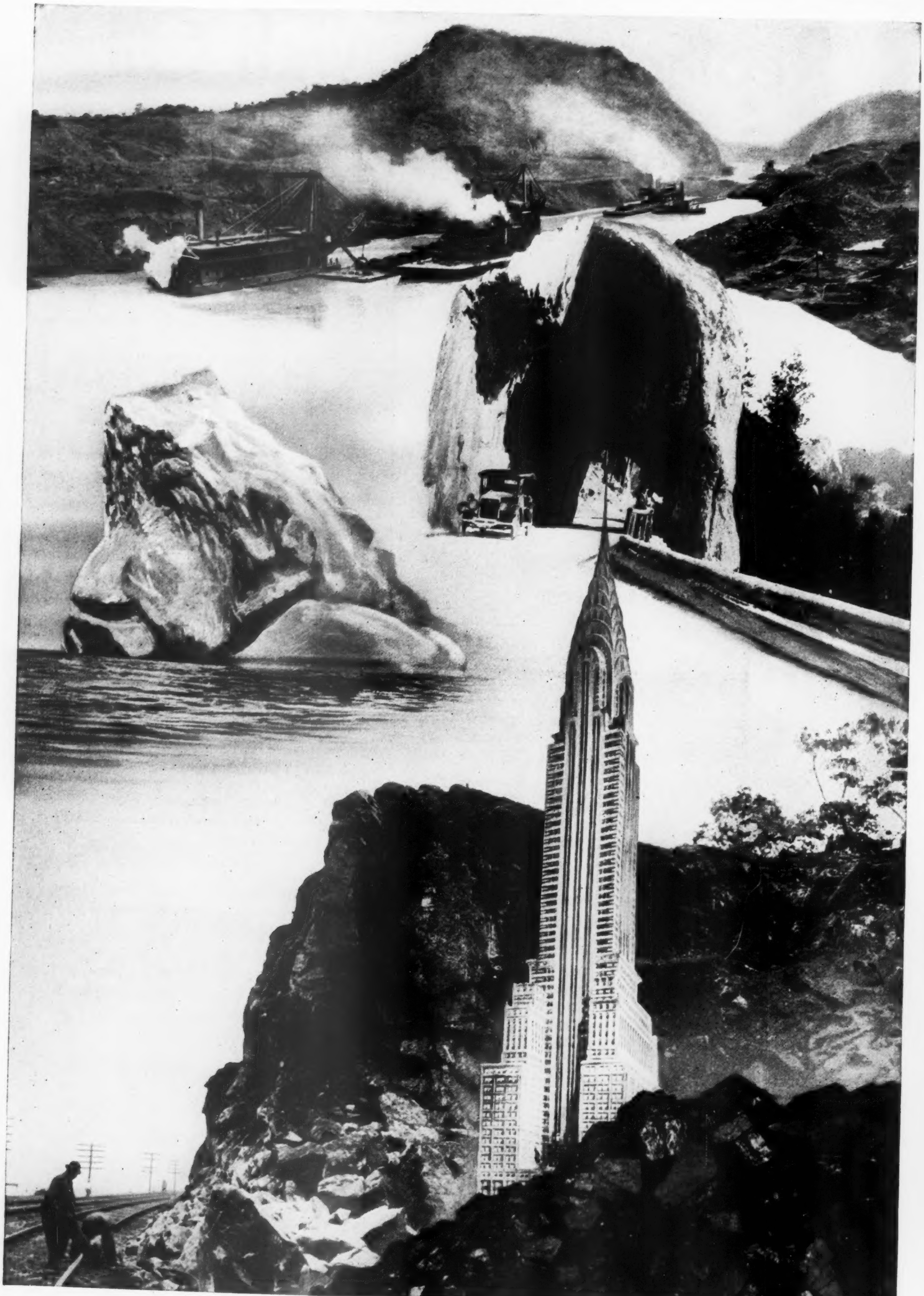
General Offices: 545 Central Avenue, Johnstown, Pa.

***SALES OFFICES:*—ATLANTA CHICAGO CLEVELAND DALLAS NEW YORK PHILADELPHIA PITTSBURGH**

Pacific Coast and Export Distributors: United States Steel Products Company

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

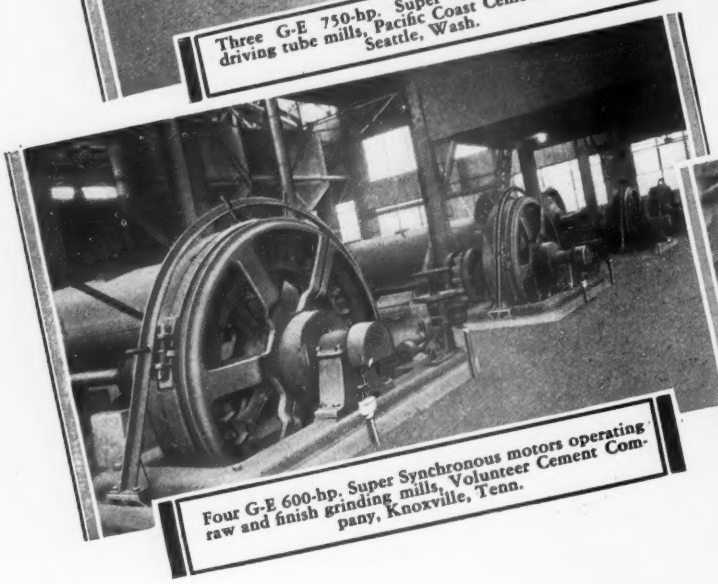




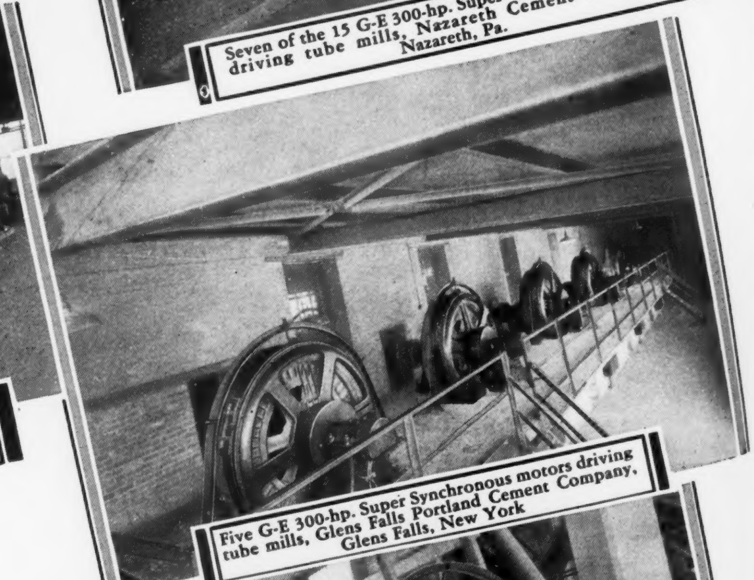
The G-E Super

Three G-E 750-hp. Super Synchronous motors driving tube mills, Pacific Coast Cement Company, Seattle, Wash.

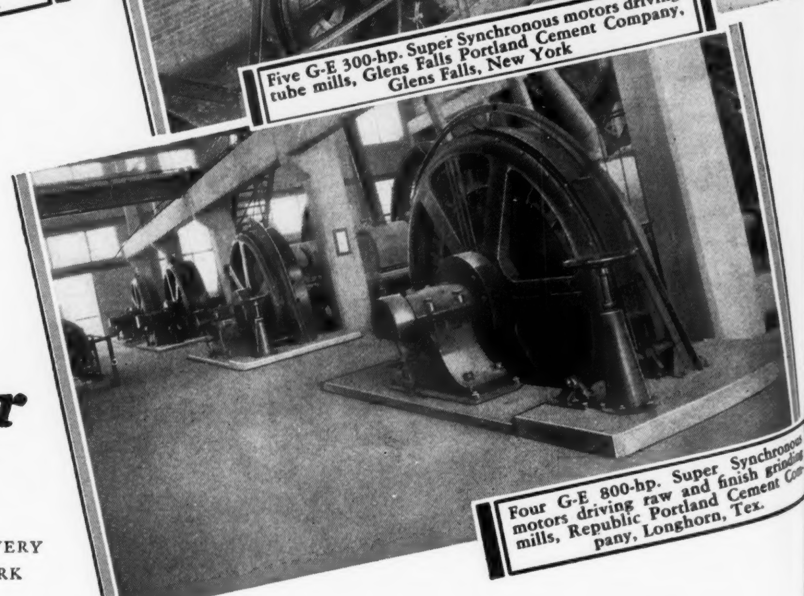
Seven of the 15 G-E 300-hp. Super Synchronous motors driving tube mills, Nazareth Cement Company, Nazareth, Pa.



Four G-E 600-hp. Super Synchronous motors operating raw and finish grinding mills, Volunteer Cement Company, Knoxville, Tenn.



Five G-E 300-hp. Super Synchronous motors driving tube mills, Glens Falls Portland Cement Company, Glens Falls, New York



Four G-E 800-hp. Super Synchronous motors driving raw and finish grinding mills, Republic Portland Cement Company, Longhorn, Tex.

GE Motorized Power
–fitted to every need

JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

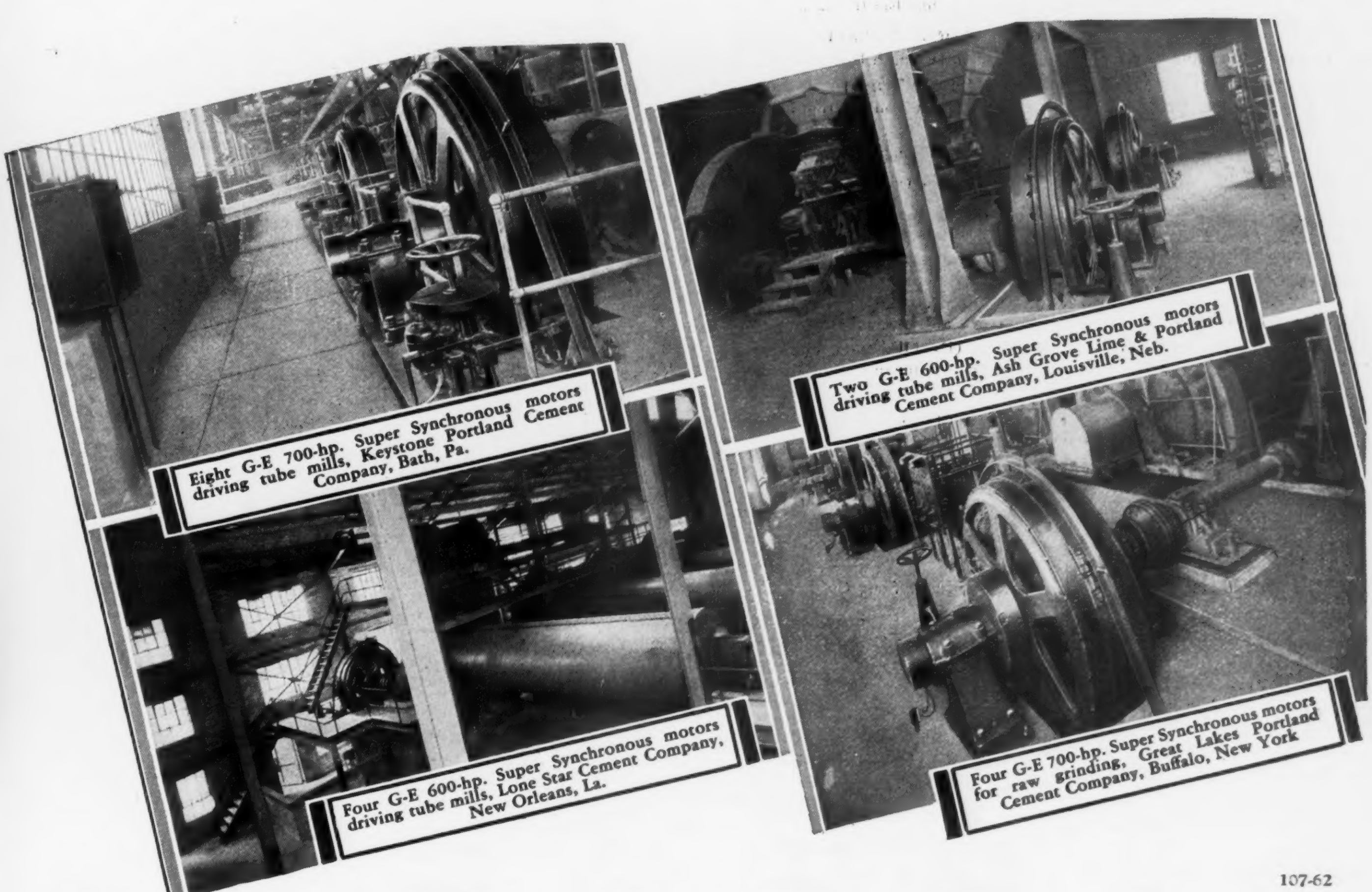
Synchronous Motor

No better motor has ever been developed for tube-mill drive

IN 1922, General Electric developed the Super Synchronous motor to meet the demand for a simple, economical, and reliable synchronous-motor drive for raw and finish grinding mills and other high-starting-torque loads.

In starting a Super Synchronous motor, the operator merely presses a button. The stator begins to revolve, comes up to synchronous speed, and then a brake is applied. This brake may be either hand- or motor-operated. As the stator slows down, the rotor picks up the load, gently and without excessive strain, and brings it up to speed at the will of the operator. Operating conditions are ideal.

The superiority of Super Synchronous motors for heavy-duty starting service remains unquestioned after eight years, during which time more than 300 have been installed. They are manufactured exclusively by General Electric. G-E specialists in the nearest office will give you complete information.



Eight G-E 700-hp. Super Synchronous motors driving tube mills, Keystone Portland Cement Company, Bath, Pa.

Two G-E 600-hp. Super Synchronous motors driving tube mills, Ash Grove Lime & Portland Cement Company, Louisville, Neb.

Four G-E 600-hp. Super Synchronous motors driving tube mills, Lone Star Cement Company, New Orleans, La.

Four G-E 700-hp. Super Synchronous motors for raw grinding, Great Lakes Portland Cement Company, Buffalo, New York

107-62

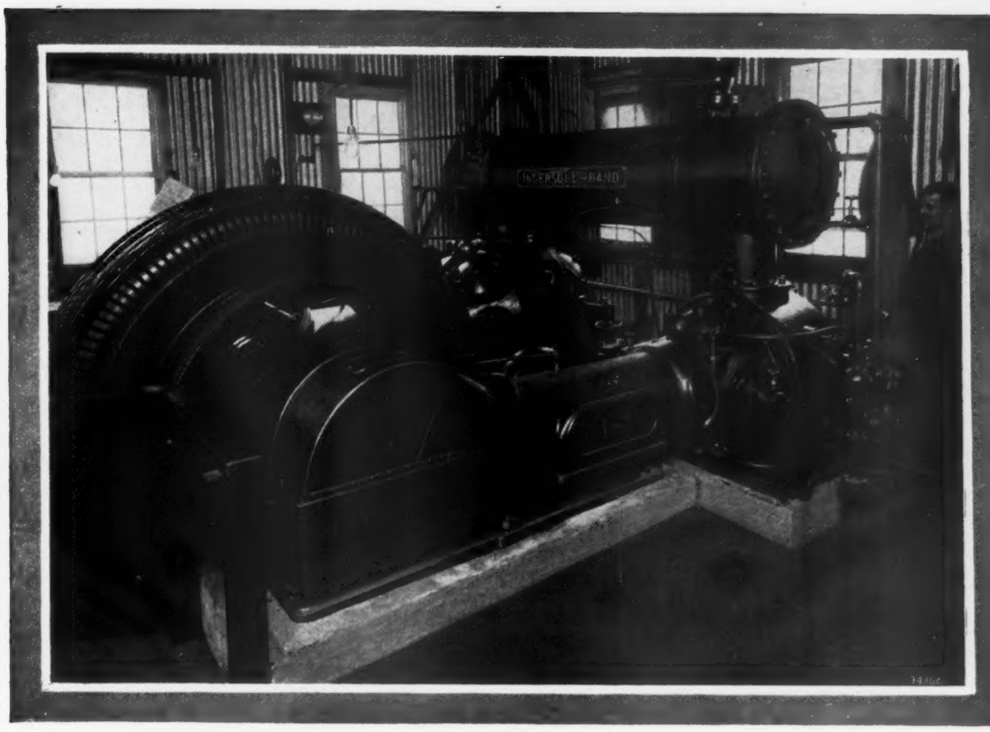
ELECTRIC

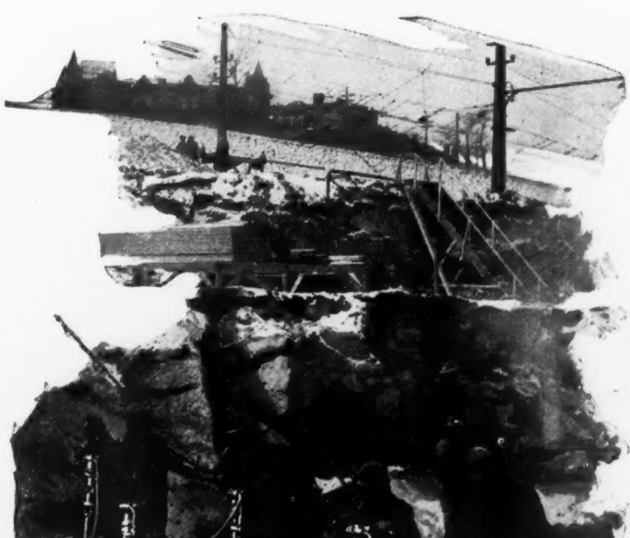
SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

Classified Directory of Advertisers in this Issue of Rock Products

For alphabetical index, see page 152

This classified directory of advertisers in this issue is published as an aid to the reader. Every care is taken to make it accurate, but ROCK PRODUCTS assumes no responsibility for errors or omissions. The publishers will appreciate receiving notice of omissions or errors, or suggestions



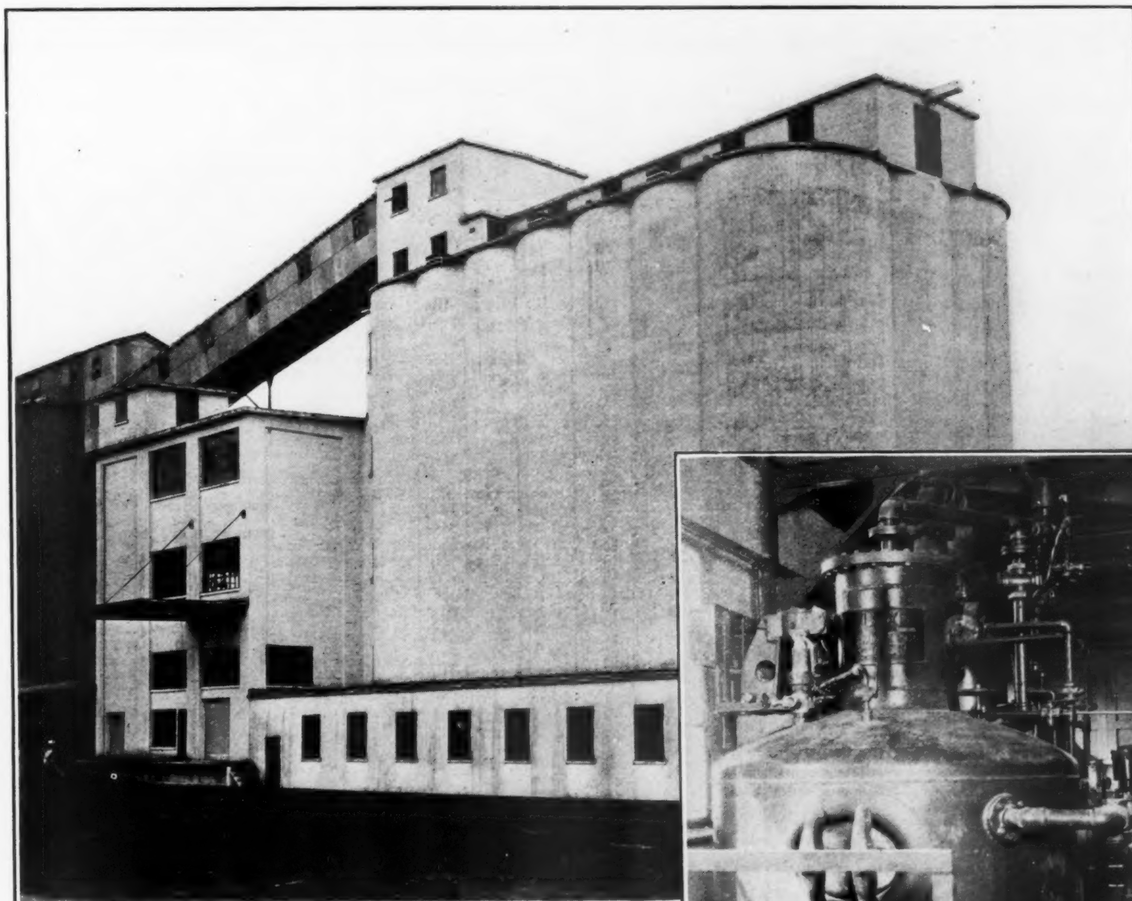


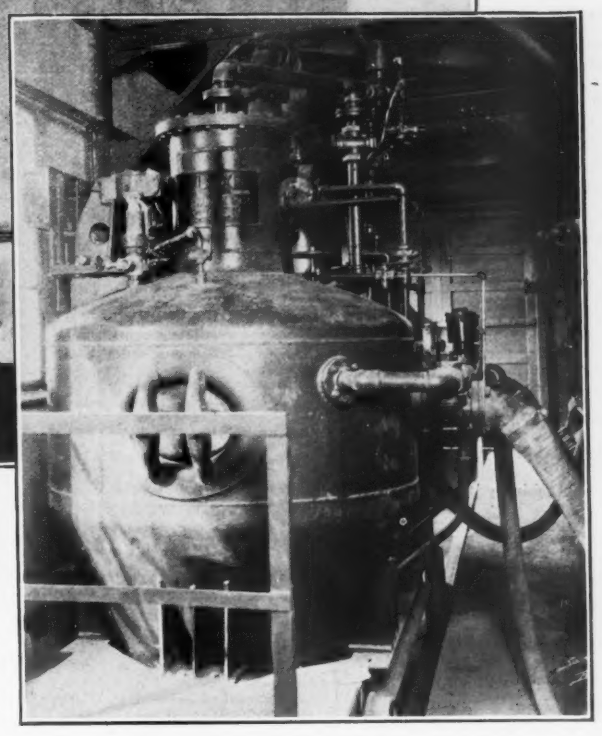
Ingersoll-Rand "Jackhamers" on excavating work

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 152

PUMPING CEMENT





THE FLUXO PUMP

FOR ECONOMICAL PNEUMATIC TRANSPORT . . . .

The Fluxo has proved a very economical means for the pneumatic transport of dry pulverulent materials, such as cement, raw mix, lime, etc.

The illustration shows a Fluxo pumping cement from storage silos to bins over packing machines, and also from silo to silo. The operation is automatic and very simple.

When employed for removing the contents of silos, the Fluxo is installed outside the silo, drawing the material through a flexible hose from convenient points at the bottom of the silo. Thus no tunnels are required, simplifying the silo construction.

Forty systems have been sold to date.

Information regarding the application of the Fluxo pump to your transport problem will be gladly furnished.

F. L. SMIDTH & COMPANY

ENGINEERS

225 Broadway ~ ~ **New York, N. Y.**

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 152

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 152

Railway Equipment
General Electric Co.
Westinghouse Electric & Mfg. Co.

Refractories
Harbison-Walker Refractories Co.

Respirators
Willson Products, Inc.

Road Machinery
Bucyrus-Erie Co.
Good Roads Machy. Co., Inc.
Harnischfeger Corp.
Industrial Brownhoist Corp.
Marion Steam Shovel Co.
Northwest Engineering Co.
Smith Engineering Works

Rock Drills (See Drills, Rock)

Rod Mills
Hardinge Company, Inc.
Jackson & Church Co.
Traylor Eng. & Mfg. Co.

Roller Bearings
The Timken Roller Bearing Co.

Rope (Wire) (See Wire Rope)

Safety Appliances
Pangborn Corporation
Willson Products, Inc.

Sand-Blast Equipment
Pangborn Corporation

Sand Separators
Allen Cone and Machy. Corp.
Stephens-Adamson Mfg. Co

Sand Settling Tanks
Allen Cone and Machy. Corp.
Link-Belt Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.

Scales (Automatic Proportioning)
Richardson Scale Co.

Scales (Cement)
Richardson Scale Co.

Scrapers (Power Drag)
The Hayward Co.
Link-Belt Co.
Northwest Engineering Co.
Sauerman Bros.

Screens
Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Cleveland Wire Cloth & Mfg. Co.
Cross Engineering Co.
The Deister Concentrator Co.
Eagle Iron Works
Good Roads Machy. Co., Inc.
Harrington & King Perf. Co.
Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Link-Belt Co.
McLanahan & Stone Machine Co.
Morrow Mfg. Co.
Ross Screen & Feeder Co.
Orville Simpson Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
Sturtevant Mill Co.
W. Toepfer & Sons Co.
Traylor Eng. & Mfg. Co.
W. S. Tyler Co.
Universal Vibrating Screen Co.
Williams Patent Crusher & Pulverizer Co.

Screens (Self Feeding)
Ross Screen & Feeder Co.

Screens, Vibrating
Deister Machine Co.
Link-Belt Co.
Ross Screen & Feeder Co.
Orville Simpson Co.
Sturtevant Mill Co.
Traylor Vibrator Co.
W. S. Tyler Co.
Universal Vibrating Screen Co.

Seal Rings (Kilns, Coolers and Dryers)
Bethlehem Fdy. & Machine Co.

Seal Rings (Rotary Kiln)
Huron Industries, Inc.

Separators, Air (See Air Separators)

Separators, Electro Magnetic
Dings Magnetic Separator Co.

Separators (Magnetic)
C. G. Buchanan Co., Inc.
Dings Magnetic Separator Co. (Wet)

Separators (Slurry)
F. L. Smidth & Co.

Shaft Sinking
E. J. Longyear Company

Sharpening Machines, Drill (See Drill Sharpening Machines)

Shovels, Power (Steam, Gas, Electric, Diesel, Oil)
Bucyrus-Erie Company
Harnischfeger Corp.
Industrial Brownhoist Corp.
Link-Belt Co.
Manitowoc Engineering Works
Marion Steam Shovel Co.
Northwest Engineering Co.
Ohio Power Shovel Co.
Osgood Company
Thew Shovel Co.

Signals (Mine and Quarry)
Traylor Vibrator Co.

Silos
Burrell Eng. & Const. Co.
Macdonald Eng. Co.
F. L. Smidth & Co.

Skip Hoists and Skips
Link-Belt Co.
Vulcan Iron Works

Slings (Wire Rope)
American Cable Co.
A. Leschen & Sons Rope Co.
John A. Roebling's Sons Co.

Slugs (See Grinding Balls and Nuggets)

Slurry Filter Cloth
National Filter Cloth & Weaving Co.

Speed Reducers
The Falk Corp.
Farrel-Birmingham Co., Inc.
Huron Industries, Inc.

Spouts, Chutes (See Chutes and Chute Liners)

Spouts (Magnetic)
Dings Magnetic Separator Co.

Sprockets and Chain
American Manganese Steel Co.

Steel (Bars, Shapes, Plates, etc.)
Joseph T. Ryerson & Son, Inc.
The Timken Roller Bearing Co.

Steel (Electric Furnace)
The Timken Roller Bearing Co.

Steel Fabrication
Maryland Metal Bldg. Co.

Steel (Open Hearth)
The Timken Roller Bearing Co.

Steel Plate Construction
Hendrick Mfg. Co.

Steel (Special Alloy—See also Manganese Steel)
Bethlehem Steel Co.
The Timken Roller Bearing Co.

Steel (Special Analysis)
The Timken Roller Bearing Co.

Steel (Structural)
Bethlehem Steel Co.

"Stellited" (Die Rings, etc.)
Bethlehem Fdy. & Machine Co.

Stokers
Combustion Engineering Corp.

Storage Equipment
Sauerman Bros.
Stephens-Adamson Mfg. Co.

Structural Steel (See Steel, Structural)

Tanks
Combustion Engineering Corp.
Link-Belt Co.
Smith Engineering Works

Testing Sieves and Shakers
W. S. Tyler Co.

Thickeners
Hardinge Co., Inc.
Traylor Vibrator Co.

Tool Sheds
Maryland Metal Bldg. Co.

Tool Steel
Bethlehem Steel Co.

Tools, Drill (See Drilling Accessories)

Tools, Pneumatic
Ingersoll-Rand Company

Track Equipment
Bethlehem Steel Co.
Easton Car & Construction Co.

Track Shifters
Nordberg Mfg. Co.

Trailer Cranes (See Cranes)

Trailers, 3-Way Dump
Athey Truss Wheel Co.

Tramways (Aerial Wire Rope)
Interstate Equipment Corp.
A. Leschen & Sons Rope Co.
Macwhyte Co.

Transmission Belting
Goodyear Tire & Rubber Co., Inc.

Transmission Machinery
Allis-Chalmers Mfg. Co.
Farrel-Birmingham Co., Inc.
Huron Industries, Inc.
Kritzer Co.
Stephens-Adamson Mfg. Co.
The Timken Roller Bearing Co.

Trenchers (Wheel and Ladder Type)
Harnischfeger Corp.

Truck Cranes (See Cranes)

Tube Mills (See Mills, Ball, Tube, etc.)

Tube Mill Liners (See Mill Liners)

Tubing (Seamless Steel)
The Timken Roller Bearing Co.

Tunnelling Machines
Bucyrus-Erie Co.
Harnischfeger Corp.
E. J. Longyear Company

Turbines
Westinghouse Electric & Mfg. Co.

Turntables
Easton Car & Constr. Co.

Underground Loaders
Bucyrus-Erie Co.
Thew Shovel Co.

Valves
Merco Nordstrom Valve Co. (Lubricated Plug)

Ventilating Apparatus
Pangborn Corporation

Vibrating Screens (See Screens, Vibrating)

Wagons, Dump
The Winsor Company (Subsidiary of Ohio Locomotive Crane Co.)

Wagons and Trailers, Heavy Duty
Athey Truss Wheel Co.

Wagons and Trailers, Dump
Athey Truss Wheel Co.

Washers (Sand, Gravel and Stone)
Allen Cone and Machy. Corp.
Allis-Chalmers Mfg. Co.
The Deister Concentrator Co.
Deister Machine Co.
Eagle Iron Works
Link-Belt Co.
McLanahan & Stone Machine Co.
F. L. Smidth & Co.
Smith Engineering Works
Stephens-Adamson Mfg. Co.
W. Toepfer & Sons Co.
Traylor Eng. & Mfg. Co.

Waste Heat Boilers
Combustion Engineering Corp.

Watchmen's Shelters
Maryland Metal Bldg. Co.

Water Softening Systems
Deister Machine Co.

Weighing Equipment
Merrick Scale Mfg. Co. (Automatic Proportioning)
Richardson Scale Co.
Schaffer Poidometer Co.

Welding and Cutting Apparatus
General Electric Co.
Jos. T. Ryerson & Son, Inc.
Westinghouse Electric & Mfg. Co

Welding Wire
John A. Roebling's Sons Co.

Well Drills (See Drills, Well)

Wheels (Car)
American Manganese Steel Co.
Eagle Iron Works
Easton Car & Construction Co.
Vulcan Iron Works

Wheels, Track Laying Type
Athey Truss Wheel Co.

Whirleys
Dayton-Whirley Co.

Winches and Capstans
Ingersoll-Rand Company
Stephens-Adamson Mfg. Co.

Wire Cloth
Cleveland Wire Cloth & Mfg. Co.
John A. Roebling's Sons Co.
W. S. Tyler Co.

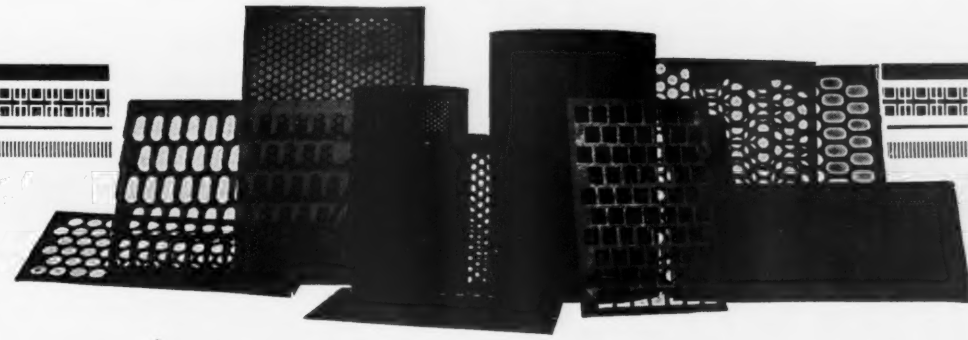
Wire Rope
American Cable Co.
A. Leschen & Sons Rope Co.
Macwhyte Co.
John A. Roebling's Sons Co.

Wire Rope Fittings
American Cable Co.
A. Leschen & Sons Rope Co.
Macwhyte Co.
John A. Roebling's Sons Co.

Wire Rope Slings (See Slings, Wire Rope)

Worm Gears (See Gears)

Wrenches
John A. Roebling's Sons Co.



WHERE DOLLARS BUY MORE

YOUR dollars invested in MORROW SCREENS buy more in screens and screening service because MORROW SCREENS give you "greater wear per ton" for every dollar invested. This is not a theory but an established fact proven by operators themselves.

MORROW SCREENS retain their accuracy and result in the production of more accurately graded material at lower cost. Our bulletin 55 will prove of interest to you.

Send for your copy today

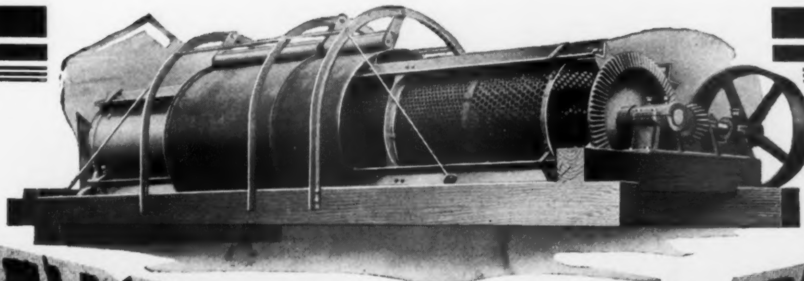
THE MORROW MFG. CO. — QUALITY MORROW SERVICE — WELLSTON - OHIO

Two million barrels

of high grade cement are produced annually in this plant. Harbison-Walker refractories play an important part in helping to maintain this production.

No one brand or type of refractory can be expected to give the most economical results under all the varied conditions of service. An intimate knowledge of the requirements of the industry enables Harbison-Walker to make proper recommendations.

Harbison-Walker Refractories Co.
Pittsburgh, Pa.
World's Largest Producer of Refractories



TOEPFER SCREENS

ANOTHER "TOEPFER" FEATURE

A FEATURE of our latest model is a Sand Jacket having a smooth outside surface, upon which hinged rollers rotate.

Particles that might otherwise become lodged in the perforations of the sand jacket are forced back by these rollers—assuring greatest screening capacity.

High carbon manganese content perforated steel screen plates—nickel iron Trunnion Ring and large diameter cast steel Trunnion Rollers mounted on either babbitted or roller bearings are added features.

Cast steel stiffener ribs are furnished with all screens 16′0″ and over in length to assure maximum rigidity. Screens are furnished in diameters and lengths to meet all requirements with either all steel or timber frames.

Let Us Send Full Details

W. TOEPFER & SONS COMPANY

955-965 Thirtieth Street **Milwaukee, Wisconsin**

Wiley Whirleys

THE WILEY WHIRLEY—A traveling, revolving, long reach, heavy duty steel derrick.

The Dayton Whirley Co.

Dayton, Ohio

INCREASE OUTPUT

MOBILITY, long live boom, full circle swing, large bucket capacity, powerful engines, fast hoisting and swinging speeds, easy operation — are the things that make for large output in sand and gravel operations. WILEY-WHIRLEYS have them all.

Six Models available with booms 50 to 100 feet and bucket capacities up to $3\frac{1}{2}$ yards. Steam, electric or gasoline power. Rollers, track wheels or gantry mounting. Self-propulsion, if desired.

Send coupon for catalog

THE DAYTON-WHIRLEY CO.
Dayton, Ohio, U. S. A.

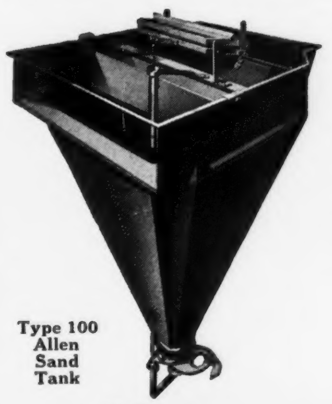
Please send me the WILEY WHIRLEY Catalog.

NAME..............................

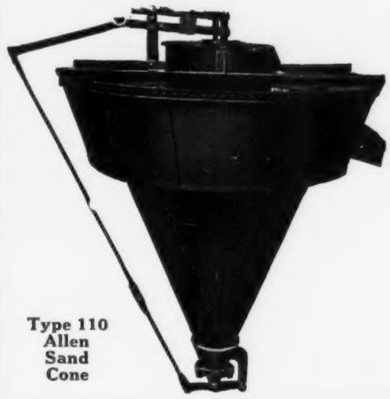
COMPANY..............................

ADDRESS..............................

ALLEN CONES AND TANKS



Type 100 Allen Sand Tank



Type 110 Allen Sand Cone

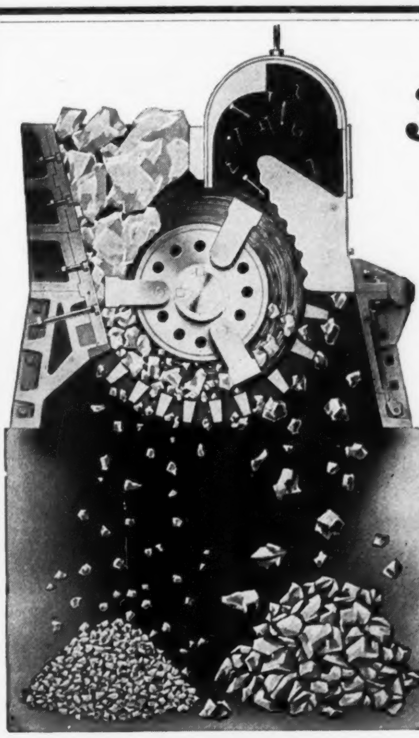
THIS equipment represents the utmost in dependability and accuracy. Allen Cones and Tanks relieve you of constant attention as they work automatically.

A clean, dewatered, uniform, accurately classified product is certain. The installation of Allen Cones and Tanks frequently results in two or three products being made from materials that are now wasted or sold as a single product.

From a small representative sample of your bank, our engineers can predetermine the various products obtainable and often suggest new fields or applications for these products.

ALLEN CONE & MACHINERY CORP.
ENGINEERS
30 Church Street — — New York City

3 to 4 Times More Wear



That's what you can expect from the Gruendler patented renewable hammer. This solves the problem of tough or hard stone, gravel, etc. The GRUENDLER is the logical answer to the present big demand for ¾ inch to 1½ inch stone.

GRUENDLER CRUSHERS with their impact principle of design give you the most uniform product minus slivers. These crushers handle larger stones and assure greater reduction than is possible through any other principle. On a comparison for power, it has unequaled capacity.

Two-Piece Hammer With Renewable Tip

For a decided saving the GRUENDLER is in the lead. It will operate at lowest cost per ton—assures uniform aggregate and can be had in capacities from 10 to 400 tons per hour.

Send for the GRUENDLER literature today. Ask for catalogue R&G 600.

Gruendler Crusher and Pulverizer Company
St. Louis Missouri

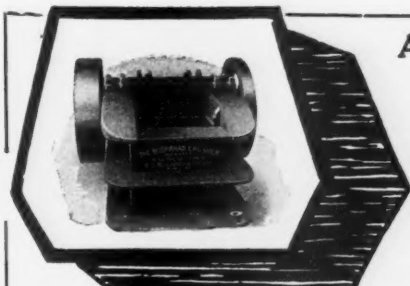
Cement Mill Repair Parts

Include

- Agitators
- Air Seals (Kiln)
- Bin Gates
- Elevator and Conveyor Buckets
- Elevating and Conveying Chains
- Chutes and Chute Liners
- Conveyor Idlers and Rolls
- Conveyors and Elevators
- Screw Conveyors
- Coolers
- Flexible and Shaft Couplings
- Crusher Parts
- Steam Shovel
- Dippers and Teeth
- Dryers
- Feeders
- Hoppers and Spouts
- Idlers
- Kilns
- Mills
- Ball and Tube Mills
- Pulleys
- Sheaves
- "Stellited" Parts
- Transmission Machinery, etc.

Pacific Coast Representative:
W. S. Weaver, 609 Wright-Callender Building, Los Angeles, Cal.

BETHLEHEM FOUNDRY & MACHINE CO., Bethlehem, Pa.



All-Steel Crushers

The Buchanan Type B All-Steel Crusher is unusually efficient and capable of low cost production when used as a secondary crusher in medium to large size plants, or as a primary crusher in small to medium size plants. In either service it is dependable, efficient, economical and accessible for adjustments and replacement of parts. It will pay you to write for details and know the construction features that make possible this higher type of crusher performance.

BUCHANAN

C. G. Buchanan Company, Inc., 90 West St., New York, N. Y.

SHAW

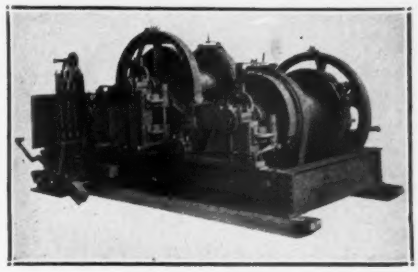
Electric Traveling Cranes

made at Shaw-Crane Works, Muskegon, Mich.

by Manning, Maxwell & Moore, Inc.

100 East 42nd Street
New York City

Branches: Chicago, Detroit, Philadelphia, Pittsburgh, St. Louis



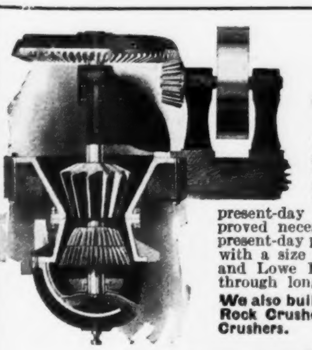
STREET

Slackline Hoists are known for dependability and ease of operation. They are built with just an added touch of Tomorrow.

Ask for Bulletin

HOIST DERRICK, CABLEWAYS, SLACKLINE EXCAVATORS

STREET BROS. MACHINE WORKS, INC.
Chattanooga, Tenn.



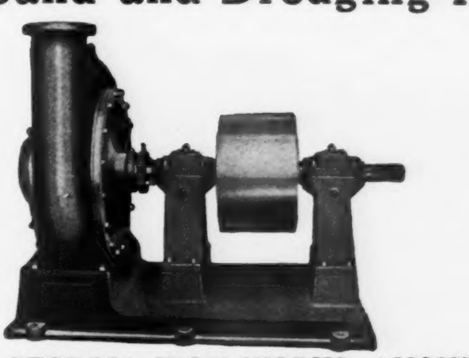
ROTARY CRUSHERS

Butterworth and Lowe Rotary Crushers are the result of more than 86 years of specialized experience, and embody not only the original design that has made them the accepted standard, but those present-day engineering principles that have been proved necessary to the efficiency and economy of present-day production. Of the double reduction type, with a size to meet every requirement, Butterworth and Lowe Rotary Crushers give greatest capacities through long, economical service.

We also build Gypsum Machinery, Calcining Kettles, Rock Crushers, Jaw Crushers, Rotary Crushers, Roll Crushers.

Oliver Machinery Company
Grand Rapids, Michigan, U.S.A.
HIGH GRADE MACHINERY

Sand and Dredging Pumps



A Wide Range of Sizes and Types, 4" to 14"

Send for illustrated booklet

GEORGIA IRON WORKS, AUGUSTA, GA.

ROTEX
HEAVY DUTY SCREENS

The ORVILLE SIMPSON COMPANY

1231 KNOWLTON ST., CINCINNATI, OHIO

Hardinge Mills

Ball Mills—Catalog 13B
Rod Mills—Bulletin 25

Ruggles-Coles Dryers

Catalog No. 16B

Hardinge Company, Inc.
YORK, PA.

122 East 42nd St.
New York, N. Y.

Continental Bank Building
Salt Lake City

It is part of Rock Products' conception of its duty to readers and subscribers to help them in every possible and legitimate way. The "Situations Vacant" and "Situations Wanted" advertisements are a part of this service. The charges of 2 cents a word, or a minimum charge of a dollar per insertion, are nominal and not designed for profit. Numerous letters from these advertisers assure us of the effectiveness of these advertisements in finding capable men for openings and of finding openings for capable men.

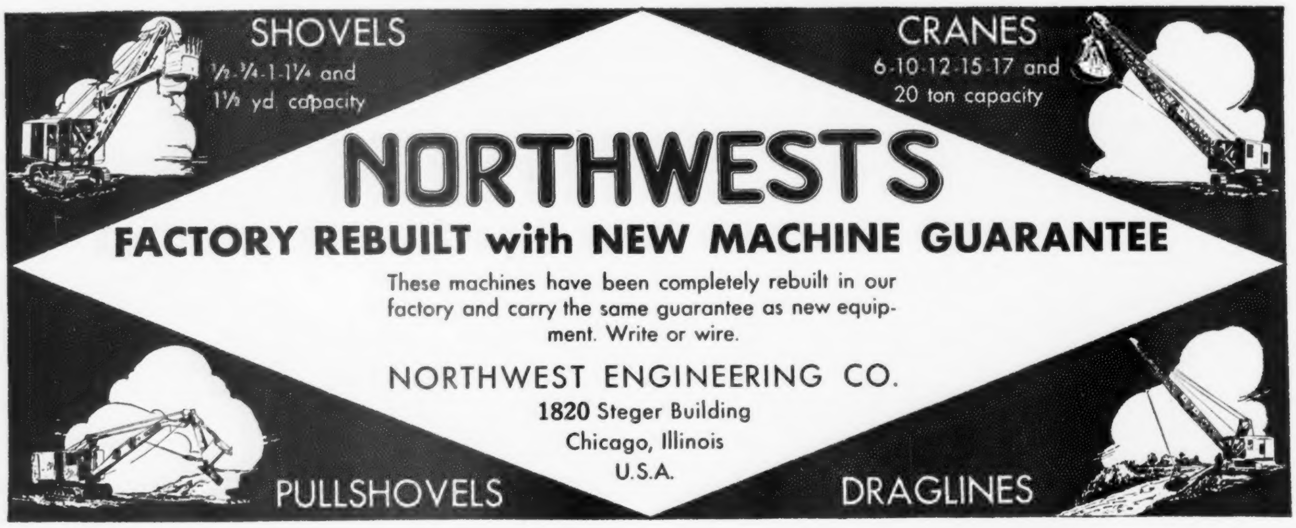
Classified Advertisements

POSITIONS WANTED — POSITIONS VACANT
Two cents a word. Set in six-point type. Minimum $1.00 each insertion, payable in advance

INFORMATION
Box numbers in care of our office. An advertising inch is measured vertically in one column. Three columns, thirty inches to the page.

CLASSIFIED—Displayed or undisplayed. Rate per column inch, $4.00. Unless on contract basis, advertisements must be paid for in advance of insertion.

USED EQUIPMENT



FOR SALE

CRANES, ETC.

P. & H. Model 206, ¾-yd. Dragline.
Byers, 10-ton Cater. Crane, ¾-yd. Clam.
O. & S. 22½-ton Loco. Crane, 50′ Boom.

CARS

16—12-yd. Western, Steel Beam Dump Cars.
10—50-ton Capy., All Steel Twin Hopper Cars.

LOCOMOTIVES

75-ton, 20x26″, 6-Dr. Switcher, A.S.M.E.
50-ton, 18x24″, 6-Driver Switcher.
92-ton, 20½x28″, Mikado (2-8-2), Built 1922.
35-ton, 13x20″, 4-Driver Saddle Tank, A. S. M. E.
56-ton, 18x24″, 4-Driver Saddle Tank.

We have over forty locomotives in stock, rebuilt and ready, all types, 10 to 100 tons

SOUTHERN IRON & EQUIPMENT CO.
Est. 1889 Atlanta, Georgia

We buy and sell modern equipment for Contractors, Quarries, and Sand and Gravel Plants.

A. J. O'NEILL CO.
406 Weightman Building
Philadelphia, Pa.

IN A-1 CONDITION

2—8x20-ft. Bruckner Type **Rotary Roasters.**
6x40-ft. Vulcan **Rotary Kiln.**
7x100-ft. **Rotary Kiln.**
50—**Steel Tanks,** various sizes.
7½ **Gyratory Crusher.**
15—30-in. gauge **Rack Dryer Cars.**
2—14x8-in. **Jaw Crushers.**
1—300-kw. **Oil Engine Generator Unit.**
1—6x125-ft. Self-Supporting **Steel Stack.**

The Equipment Sales Company
R. W. Storrs, Jr., Mgr.
Richmond, Virginia

FOR SALE

Plymouth Locomotive, 24 inch gauge, Model AL, 3 ton. Good working condition.

INLAND LIME AND STONE COMPANY
Manistique Michigan

CONSTRUCTION EQUIPMENT

For Sale or Rent

Overhauled in our own shops and guaranteed subject to thorough trial in service

19—**LOCOMOTIVES:** Steam and Gasoline 7 to 50 tons, Narrow and Standard Gauge.
252—**DUMP CARS:** 4-yd. to 30-yd. Hand and Air Dump, Narrow and Standard Gauge.
26—**GASOLINE CRANES, SHOVELS, DRAGLINES:** ¾ to 1¼-yd. Link-Belt, Northwest, Harnischfeger, Koehring.
7—**LOCOMOTIVE CRANES:** 15 to 30-tons, Ohio, Brownhoist, Industrial, Browning.

MISCELLANEOUS CONSTRUCTION EQUIPMENT: Air Compressors, Gas and Steam Rollers, Pile Hammers, Pumps, Hoists, etc.
STEAM SHOVELS: Full Revolving Caterpillar and Railroad Types.
SPREADER CARS: Narrow and Standard Gauge, All-Steel, Air-Operated.
DRAGLINES: Caterpillar or skid and roller mounting, 50 to 155 ft. booms.
SHOVEL REPAIRS: Bucyrus, Marion, Link-Belts, etc.

CLAPP, RILEY & HALL EQUIPMENT CO.
18 No. Clinton St., Chicago, Ill. **458 Union Trust Bldg., Pittsburgh, Pa.**

CLASSIFIED ADVERTISEMENTS

POSITIONS WANTED — POSITIONS VACANT
Two cents a word. Set in six-point type. Minimum $1.00 each insertion, payable in advance.

INFORMATION
Box numbers in care of our office. An advertising inch is measured vertically in one column. Three columns, thirty inches to the page.

CLASSIFIED—Displayed or undisplayed. Rate per column inch, $4.00. Unless on contract basis, advertisements must be paid for in advance of insertion.

USED EQUIPMENT

FOR SALE

SPECIALS

4—28"x36", 24"x36" Traylor Jaw Crushers.
1—36"x54" Buchanan Jaw Crusher.
1—24"x36" Farrel 15-B Jaw Crusher.
20—Gyratory Crushers, 42" McCulley, 30" McCulley, 10 K Gates, 10 Austin, 9 K Gates, 8 Gates, 8 Kennedy, 7½ Kennedy, 16 Traylor, 14" new Allis-Chalmers, 37 Kennedy, and all smaller sizes.
1—6" McCulley Fine Red. Crusher, rebuilt.
1—7" Newhouse with 60 HP. 3/60/220 motor.
6—4x16, 40"x20', 4x20 Allis-Chalmers Screens.
3—36"x16" Allis-Chalmers and Traylor Rolls.
3—20"x14" Allis-Chalmers and Sturtevant Rolls.
2—5'6"x20' Smith Silex Lined Tube Mills.
4—2-5 roll Raymond High Side Mills.
3—6'x22", 6'x30" Hardinge Ball Mills.
2—36x24", 42x36" Jeffrey Swing Hammer Mills.
20—4x20, 4x30, 5x30, 6'6"x40, 6x60, 8'x60' Direct Heat Rotary Dryers.
2—New 4'x5' No. 37 Tyler Screens, 2 and 3 surface.
1—Tyler Screen No. 31, 3 deck, two 4x5 sections.
4—30" and 14' dia. Gayco Air Separators.
1—No. 32 Marcy Ball Mill.

Jaw, Gyratory, Roll Crushers, all sizes, types. Rotary Kilns, Dryers, all sizes, types, not listed above. Swing Hammer Mills, all sizes, types.

We have just issued latest List No. 10. Request your copy.

Consolidated Products Co.
INCORPORATED
17-19 Park Row New York City
Barclay 0600
Shops and Yards at Newark, N. J., Cover Six Acres
WE WILL BUY YOUR SURPLUS MACHINERY

SHOVELS or CRANES for Sale or Rent

Rental Payments May Apply on Purchase

One factory rebuilt LIMA "101" 1¼ cu. yd. capacity. This machine can be equipped with either shovel, clamshell, dragline or drag shovel attachments. Very reasonably priced. Carries new machine guarantee. Located at Lima, Ohio.

One B-2 Erie steam shovel, 1 cu. yd. capacity, in very good condition. Located in Brooklyn, N. Y.

One Osgood ¾ cu. yd. steam combination shovel and crane, caterpillar mounted. This machine is in very good condition. Its price is extremely low. Located at Peoria, Ill.

One General excavator combination gasoline shovel and crane. ½ cu. yd. capacity in almost new condition. Located at Staten Island, N. Y.

One type "O" ¾ yd. Thew steam shovel center drive truck, in splendid condition. Priced right. Can be purchased on liberal terms. Located at Brooklyn, N. Y.

One Lorain 75-A, combination shovel and clamshell. Purchased new September, 1929. In almost new condition. Located in Eastern Pennsylvania.

One complete shovel attachment for type "O" Thew steam shovel, in good condition. Reasonably priced. Located in Buffalo, N. Y.

One Linn tractor 6 yd. capacity, with Waukesha motor. Machine in very good condition. Priced to sell quickly. Located in New York State.

We have both Steam and Gasoline Excavators ranging from ½ to 1½ cu. yd. capacity in various parts of the country that will be sold at extremely low prices or leased with leased payments made applying on purchase price.

Telephone Main 4824 — **Charles F. Cohen** — **Wire or Phone at My Expense**
Lima Trust Bldg. LIMA, OHIO

LOCOMOTIVE CRANES

25-ton Browning, 8-wheel, 2-line, 50' boom.
15-ton Link-Belt, 8-wheel, 2-line, 50' boom.

SHOVELS

20-B Bucyrus Steam, Caterpillar, ¾-yard dipper, high lift, National Board Boiler.
105 Northwest Gas Shovel, 1-yard dipper.

LOCOMOTIVES

72-ton 20x26" American 6-wheel switcher.
60-ton 19x26" American 6-wheel switcher.
50-ton 17x24" Davenport 6-wheel switcher.
30-ton 12x18" American 4-wheel saddle tank.
33-ton 13x18" Vulcan 4-wheel saddle tank.
50-ton 16x24" American 4-wheel saddle tank.
60-ton 18x24" Porter 6-wheel saddle tank.

BIRMINGHAM RAIL & LOCOMOTIVE CO.
Box 391
Birmingham Alabama

FOR SALE

2—Erie City 400 H.P. Boilers with Jones Underfeed Stokers and Foster Superheaters complete with engine-driven fan and fittings.
1—Erie City Lentz Cross Compound 22" x 37" x 27 Engine.
1—Erie City Lentz 19 x 21 Horizontal Engine Condenser Feed Water Heater, Boiler Feed Pump and several Steam Pumps.
1—Westinghouse 750 K.V.A.—A.C. Generator with exciter and silent chain drive.
1—Canadian G. E. 250 K.V.A.—A.C. Generator with 9½ K.W. Co. imp. wound, direct current generator exciter.
1—English Electric, 60 H.P. Squirrel Cage Motor, 720 R.P.M.
1—English Electric, 75 H.P. Slip Ring Motor, 1200 R.P.M. with starter.
2—Superior Crushing Rolls—Power and Mining.
2—Traylor 60" x 20' Revolving Screens with Dust Jackets.
1—Power and Mining 84" x 18' Revolving Screen.
1—4 x 8 Tyler, Type 60, Hummer Screen.
1—G-2 Motor Generator Set for Hummer Screen.
1—Stephans Adamson 30" Inclined Bucket Elevator, 28'6" centers.
1—110-C Bucyrus Railroad Type Steam Shovel.

TRAP ROCK, Ltd.
1510 Hanna Bldg. Cleveland, Ohio

SPECIAL—CHEAP

10—250 hp., 3 ph., 60 cy., 2200, 550, 440, 220 volt, 585 rpm. Crocker-Wheeler slip ring motors with control.
Power Plant Equipment, Transformers, Motors, Etc. Send us your inquiries
GEORGE SACHSENMAIER CO.
8411 Hegerman Street Philadelphia, Pa.

IN STOCK 250—24" gauge 2-way Western and Austin dump cars, one and one and one-half yard capacity, in good serviceable second-hand condition. Also a number of new "V" shaped dump cars, 24" gauge; rails, new and relaying and all sorts of tracks supplies of all sections.

220 East 42nd Street New York City — **M. K. FRANK** — 1204 Clark Bldg. Pittsburgh, Pa.

RAILS NEW and RECONDITIONED
ALL TRACK ACCESSORIES
CHICAGO PITTSBURGH BUFFALO INDIANAPOLIS HARRISBURG
MORRISON RAILWAY SUPPLY CORP.

FOR SALE
Complete Commercial Duntile Plant
In first class condition. Located New York. Ready to operate. Must be sold immediately at a real bargain. Don't answer unless you mean business.
OOLITIC STONE ART WORKS
Bloomington, Indiana

CLASSIFIED ADVERTISEMENTS—Used Equipment

FOR SALE

One Ingersoll-Rand (Leyner) No. 33 Drill Sharpener, complete with dollies, dies and other accessories. Price, $400.

One Ingersoll-Rand No. X-70 Drifter, for 1¼″ round steel, wet or dry work. Price, $175.

Two Ingersoll-Rand No. BCR-430 Jackhammers with shank for ⅞″ hexhollow steel, for dry work. Price, $50 each.

Above prices are f.o.b. El Paso, Texas. This equipment is in good condition.

A. COURCHESNE, INC.

Box 200 El Paso, Texas

Rebuilt and Reconditioned Excavators

Lease with Option to Buy

Byers "Bulldog" Model 127 full revolving ½-yd. crane. A good crane that is priced right. At the Chicago plant.

P&H Model 200—¾-yd. clamshell thoroughly reconditioned. A bargain at West Allis.

Erie Gas-Air clamshell crane with 1-yd. bucket. Looks and operates like new. At Chicago plant.

P&H Model 300—½-yd. clamshell or crane in good working condition. At Hoboken plant.

Marion No. 32—1-yd. steam shovel on full crawlers. Is working now and ready for immediate delivery. An exceptional bargain. Located at Pittsburgh.

Northwest No. 104—1¼-yd. shovel—reconditioned. Ready to operate. At Hoboken plant.

P&H Model 206—Crane or dragline in good operating condition at West Allis plant.

Liberal Terms

Write or wire at our expense if you do not see what you want

EXCAVATING *Exclusively*

EQUIPMENT *Excavating*

DEALERS, INC. *Equipment*

Hoboken, N. J.
1714 Willow Ave

Chicago, Ill.
1046 W. Division St.

West Allis, Wis.
5911 Greenfield Ave.

Berkeley, Cal.
2657 Ninth St.

Los Angeles, Cal.
2248 E. 37th St.

FOR SALE

Complete Electric Power Plant with Type K Anderson semi-Diesel oil engine, 225 H.P. General Electric alternating generator.
Union pump—belt drive, 1,000 gal. per minute.
Worthington pump—direct connected, 750 gal. per minute.
2 small Novo gas engines.
2 Meyers bulldozer pumps.
Delco plant—1¼ K.W.
55 H.P. semi-Diesel Anderson oil engine.
No. 4 Austin stone crusher with motor.
National hoist—direct drive.
1½ Sauerman scraper—complete, nearly new.
Northwest crane—¾ yd. Williams bucket.
Carrying and return idlers.
Head and tail pulleys.
Conveyor belt.

Various other equipment. Write for complete list

E. W. STEWARD, Trustee

44-46 Market Ave. N. W. Grand Rapids, Mich.

FOR SALE

Complete Sand Lime Brick Plant, including Crushers, Motors, Tube Mill, Jackson & Church Press, 8′ x 80′ Curing Cylinder, Engine Air Compressor, Cars, Shafting, etc. Machinery will be sold as a whole or separately. Bargain. Machinery first class condition but must be moved from present location. Plant only operated short time.

DAWES CONSTRUCTION SUPPLY CO.
Thomasville, Georgia

CRUSHING ROLLS

1—36″x16″ set of crushing rolls. Also a full list of drying, grinding, pulverizing and other mining machinery. Send us your inquiries.

HEINEKEN ENGINEERING CORPORATION

31 Nassau Street New York

Tel. Hitchcock 4378-9

Erie Steam Shovel

Crawler type, shop No. 2885, high lift, ¾-yd. dipper, boiler A. S. M. E., just overhauled and in strictly first class condition. Sacrifice price for quick sale. **Send for the latest Acme list of equipment.**

The Acme Equipment Co., Inc.
3352 Michigan Ave. Detroit, Mich.
Lafayette 3301

SHOVELS

1—KOEHRING 501, GAS, 1¼-yd., also 60′ boom.
1—LORAIN 75-A, GAS, 1¼-yd., like new.
1—NORTHWEST 104, GAS, 1¼-yd., Nov., 1928.
1—OSGOOD "Conqueror," GAS, new Jan., 1930.
1—ERIE, GAS and AIR, 1¼-yd., new 1928.
1—KOEHRING, GAS, ¾-yd., excellent condition.
1—GENERAL, GAS, ½-yd., new 1929.
3—ERIE B-2, STEAM, new 1929 and 1928.
2—MARION 32, STEAM, 1½-yd., 1930.

CRANES

1—50-B BUCYRUS-ERIE DIESEL, new 1930, 60′ boom, 1½ and 2-yd., Page Dragline Bucket.
1—40-ton cap. LINK-BELT, GAS, Dragline.
1—15-ton cap. NORTHWEST, New Oct., 1928.
1—12-ton cap. KOEHRING, 45-ft. boom, 1927.
1—12-ton cap. NORTHWEST, used 5 months.
1—6-ton BROWNING Truck-Crane, new 1929.
1—25-ton BROWNHOIST Loco. Crane, used 7 mos.

GREY STEEL PRODUCTS CO., Inc.
111 Broadway New York, N. Y.

FOR SALE
New Unused Spur Gears

1—C.I.—68-T; 2¼″ C.P.; 7¼″ F.; 6 15/16″ B.
1—C.S.—14-T; 3″ C.P.; 12″ F.; 7″ B.
1—C.I.—Shrouded—13-T; 3″ C.P.; 9½″ F. (inside) x 11″ F. (outside).
1—C.S.—Cut—16-T; 1¾″ C.P.; 6¼″ F.; 3 15/16″ B.
1—C.I.—140-T; 1¾″ C.P.; 6¼″ F.; 6 15/16″ B.
1—C.I.—Split—120-T; 3″ C.P.; 12″ F.; 10 15/16″ B.
1—C.I.—Split—88-T; 3″ C.P.; 8″ F.; 8 15/16″ B.
1—C.I.—15-T; 2″ C.P.; 7″ F.; 3 15/16″ B.

THE STANDARD LIME AND STONE COMPANY
524 Equitable Bldg. Baltimore, Md.

RAILS New and Relay

ALL WEIGHTS AND SECTIONS
FROGS—SWITCHES—TIE PLATES

S. W. LINDHEIMER INC.
38 S. Dearborn St. Chicago, Ill.

HEAVY STEEL SKIPS

34—4-yd. steel stone skips, ½″ plate, 1½ x 4 bands.

J. T. WALSH
500 Brisbane Bldg. Buffalo, N. Y.

Electric Motors

Hoists, pumps, etc. Guaranteed equipment. Inquiries and surplus lists solicited.

R. SCHEINERT
Almond and Hagert Sts. Philadelphia, Pa.

CLASSIFIED ADVERTISEMENTS

INDEX TO ADVERTISEMENTS

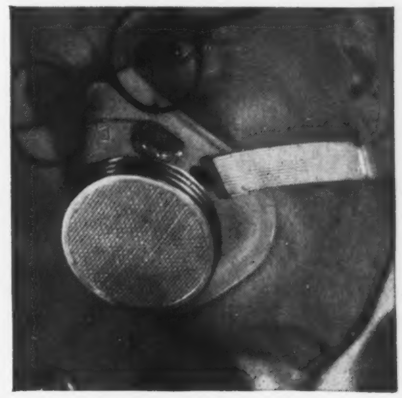
On this railroad yard elevation job, six miles of track with a raise varying from 6 to 10 feet, was accomplished without the use of jacks. The fill used was granulated and chunky slag. The Track Machine replaced the ordinary jack gang and permitted faster progress than would have been possible with hand jacks.

Write for Bulletin KS-8

NORDBERG MFG. CO. MILWAUKEE, WISCONSIN

THE NORDBERG PATENTED TRACK MACHINE

All that the name implies



WILLSON

DUSTITE No. 2

The Willson Dustite Respirator is just that—DUST-TIGHT. The molded mask made of unusually high grade rubber, fits the facial contour naturally and is just soft and flexible enough to take the shape of any face with slight headband tension. The small metal clip over the nose permits close fitting on any workman. It is light—yet durable. It is highly efficient—yet comfortable . . . and the simplicity of construction makes parts replacement easy and economical. The filter—made of special long fibre cotton keeps back the dust —but allows free and easy breathing. Relief valves let out the exhaled air, assuring normal and sanitary breathing conditions. Dustite is everything a respirator should be. Once you try it, you'll stick to it.

WILLSON PRODUCTS, Incorporated
Reading, Pennsylvania

Perforated Metal Screens

Long experience and adequate production facilities enable us to meet your every need for screen plates.

For Stone, Gravel, Sand, Cement, Coal, Ore, or any other product to be screened.

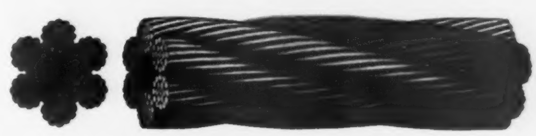
Everything in Perforated Metals. Write for prices.

THE HARRINGTON & KING PERFORATING CO.

5650 Fillmore Street Chicago, Ill. **New York Office: 114 Liberty St.**

"HERCULES" RED-STRAND WIRE ROPE

REG. U.S. PAT. OFF.



Standard Round Strand Construction

Patent Flattened Strand Construction

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